DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

CONSOLIDATED CAB DISPLAY/REMOTE
MAINTENANCE MONITOR SYSTEM

FOREWORD

This is Part 1 of a group of specification documents under the basic
heading, "Consolidated Cab Display/Remote Maintenance Monitor System
(CCD/RMMS)," each of which carries the basic number Engineering Requirement
(ER) with a slant line and a number corresponding to the part number.

These parts form an **ER** which establishes the requirements for the hardware
and software design, programming, development, hardware fabrication,
testing, delivery, installation, interfacing , and checkout of a **CCD/RMMS**
for the Federal Aviation Administration's (FAA) terminal air traffic
control system.

This **ER** was prepared in parts to allow for the procurement and
implementation of the **CCD/RMMS** in stages. The parts to be provided by the
contractor in each stage are specified in the contract.

Listing of Parts:

FAA-ER-500-007/1   Part 1 – General

FAA-ER-500-007/2   Part 2 - Display Subsystem

FAA-ER-500-007/3   Part 3 - Central Processing Subsystem

FAA-ER-500-007/4   Part 4 - Remote Transmitter/Receiver Subsystem

FAA-ER-500-007/5   Part 5 - Instrument Landing System Subsystem

FAA-ER-500-007/6   Part 6 - Lighting/RVR Subsystem

FAA-ER-500-007/7   Part 7 - Tower Interface Subsystem

1 SCOPE

1-1 Scope of Part 1.- This Part 1 contains requirements which are applicable, alone or in conjunction with other parts of this engineering requirement, to the design, fabrication, testing, installation and field validation of a CCD/RMM system to be installed and operated in FAA terminal facilities.

1-1.2 Applicable Definitions

Facility - As used in this specification, is a remote site where remote maintenance monitoring functions are performed on navaid equipment by a facility processing unit (FPU).

Interface Control Document Level I (NAS-MD-790) - An FAA document that provides the communications link control interface and protocol requirements for the exchange of information between a remote monitoring subsystem (i.e., FPU) and a central processor subsystem (CPS).

Remote Site - As used in this specification, a remote site is the location of a NAVAID to be monitored/controlled and is a data acquisition point of an FPU.

RS-449/232C - As used in this specification, RS-449/232C compatible means the contractor shall provide the capability to interface 232C or 449 devices with the central processing subsystem (CPS) or facility processing unit (FPU). This may be accomplished by having a 449 connector on the CPS and FPU with an external 449/232C adapter, or by having connectors for both 232C and 449 on the CPS and FPU.

1-1.3 Applicable Abbreviations.- Other abbreviations are defined in other parts of the E.R.

ALS	Approach Lighting System
ANSI	American National Standard Institute
ASCII	American Standard Code for Information Interchange
ATCT	Air Traffic Control Tower
CCD	Consolidated Cab Display
CPS	Central Processing Subsystem
CRT	Cathode Ray Tube
EPROM	Eraseable Programmable Read Only Memory
ER	Engineering Requirement
FAA	Federal Aviation Administration
FPU	Facility Processing Unit
GFE	Government Furnished Equipment
ICD	Interf e Control Document
ILS	Instrument Landing System
NAFEC	National Aviation Facilities Experimental Center
MALSR	Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MTBF	Mean-Time-Beteen-Failure
MTTR	Mean- ime-To-Repair
RAM	Rand Access Memory
RMMS	Remote Maintenance Monitor System
ROM	Read Only Memory
RTR	Remote Transmitter/Receiver
RVR	Runway V sual Range
TRACON	Terminal Radar Approach Control

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RVR	Runway V sual Range
TRACON	Terminal Radar Approach Control

MIL-STD-756A   Reliability Prediction

MIL-STD-785A   Reliability Program for Systems and Equipment
               Development and Production

Handbooks

MIL-HDBK-217   Reliability Prediction of Electronic Equipment

1-2.1.3 Miscellaneous Documents

American National Standard Institute

ANSI Publication X3.9-1966   FORTRAN

ANSI Standard BSR X3.66-1977

Electronic Industries Association

EIA-RS-232C   Interface Between Data Terminal Equipment and Data
               Communication Equipment Employing Serial Binary Data
               Interchange

EIA-RS-449   Interface Between Data Terminal Equipment and Data
               Circuit - Terminating Equipment Employing Serial
               Binary Data Interchange

EIA-Bulletin #12   Application Notes on Interconnection Between
                    Interface Circuits Using RS-449 and RS-232C

1-2.2 Precedence of Documents.- When requirements of the contract, this
ER, or subsidiary applicable documents are in conflict, the following shall
apply:

1-2.2.1 The Contract.- The contract shall have precedence over all other
documents.

1-2.2.2 Engineering Requirement.- The ER shall have precedence over all
subsidiary applicable documents cited herein.

1-2.3 Source of Documents

1-2.3.1 Source of FAA Documents.- Copies of the applicable FAA
specifications and drawings may be obtained from the Federal Aviation
Administration, Washington, D.C., 20591, Attention: Contracting Officer.
Requests should fully identify material desired, i.e., specification
number, dates, amendment numbers, complete drawing numbers; also, requests
should identify the invitations for bid, request for proposals, or the
contract involved, or other use to be made of the requested material.

1-2.3.2 Source of Military **Documents.-** Single copies of the Military Specifications may be obtained from the Naval Supply Depot, **5801 Tabor** Avenue, Philadelphia, PA, **19120.** Requests should cite the request for proposals or contract for which the specifications are needed.

1-2.3.3 Sources of Other **Documents.-** Copies of ANSI standards may be obtained from the American National Standards Institute, **1430** Broadway, New York, New York, **10018.** A nominal fee will be charged by ANSI for each document.

Information on obtaining copies of Federal specifications and standards may be obtained from General Services Administration Offices in Washington, **D.C.;** Auburn, Washington; San Francisco, California; Denver, Colorado; Kansas City, Missouri; Atlanta, Georgia; Chicago, Illinois; New York, New York; Boston, Massachusetts; New Orleans, Louisiana; Fort Worth, Texas; and Los Angeles, California.

1-3 Requirements

1-3.1 General System Description.- This engineering requirement establishes the requirements for a **CCD/RMMS** which will collect, process, and consolidate the display of weather, runway visual range, **NAVAID** data, etc., in the tower cab and terminal radar approach control **(TRACON)** area. **It** will also remotely monitor maintenance conditions of selected **NAVAID** equipments, process these status and alarm conditions, and display this information at a central maintenance location. Operational Requirements for Entry, Display and Display Information Processing, are contained in Appendix 2 and other parts of the **ER** for the **CCD/RMMS.**

With the availability of certification data and remote maintenance monitoring parameters, the **CCD/RMM** system shall be procured in two phases. Phase I will provide the processors , peripherals and displays identified in Parts 2 and **3.** In addition, external facility data shall be retrieved from an interface with existing field cabling in the **tower/TRACON** equipment room through a Tower Interface Subsystem defined in Part 7 of this **E.R.** Figure 1 is a graphical depiction of the Phase I system. The Phase I system shall also include the capability to expand and accept remote data when and if the remote maintenance **monitoring** parameters and certification data are defined.

The design of Phase II **CCD/RRMS** shall conform to the referenced Interface Control Documents **(ICD)** and shall, in general, be in accordance with the configuration shown in Figure 1a. It shall basically consist of a central processing subsystem, a display subsystem, and a remote site maintenance monitor subsystem for each type equipment to be monitored. The contract schedule identifies the facilities which shall be monitored/controlled.

At the present time, information such as temperature, wind speed and direction, barometric pressure, time, etc., is provided and displayed in the tower cab on separate devices. In addition, limited status information on such critical equipments as the instrument landing **systm (ILS),** lighting systems, etc., is also provided on separate indicators. At the same time, personnel who are responsible for the operation and maintenance of these and other remote airport equipments have very limited maintenance

information at the ATCT/TRACON. Therefore, the CCD/RMMS shall consolidate and provide, on electronic displays, the critical and other supplemental information required by the air traffic controller, as well as, a number of control features. In addition, the CCD/RMMS will provide the capability of monitoring specified maintenance parameters at certain remote equipment sites, processing this information, and providing this data on an electronic display at a central location.

The central processing subsystem (CPS) as detailed in Part 3 of the ER, performs the input/output, real time processing, data storage, background processing, and integrity checking functions. It shall consist of duplex processors. The CPS shall communicate with the remote sites through the Tower Interface Subsystem (Phase 1). The CPS shall continually poll each remote site for alarm information and periodically request status and certification type data. The data received from each site shall be processed and recorded for future analysis and formatted data shall be sent to various displays for use by operational and maintenance personnel. In addition, the CPS shall have the capability of transmitting control commands and messages to specific remote sites. The CPS shall provide the fail-safe capability with both automatic and manual switchover between processors. Subsystem peripherals included in the CPS are the disk storage units which shall contain the system and central software and shall provide data storage; the magnetic tape unit which shall provide for long term data storage; the CPS operator display/terminal which shall be the basic CPS input/output and control device; and the maintenance supervisory display/terminal which shall provide maintenance personnel with status and alarm information from the remote equipment sensors. Both the CPS operator and the maintenance supervisory display/terminals shall be standard 24 line by 80 character CRT type displays with a full ASCII keyboard. User capability from these positions shall be in accordance with user ID and password when logging on the system. In addition, a remote display/terminal port with auto/answer capability and a spare display/terminal port, are to be provided. The user capability from these ports shall be in accordance with the user ID and password entered when logging on the system (display/terminals for these two ports will be GFE).

The display subsystem, as detailed in Part 2 of the ER, shall consist of the following type displays in quantities specified in the contract:

        Critical Display (CD)

        Supplementary Display (SD)

        Lighting Control Panel (LCP)

        TRACON Display (TD)

        Supervisory Maintenance Display (SMD)

The Critical Display is to be located in the tower cab. The data presented

on this display is required on a continuous basis and is critical to the tower operation. The display will consist of high intensity incandescent filament modules with 9 lines by 32 characters of data in large alphanumeric or numeric form as specified in Part 2. The critical data shall be provided by the CPS and shall be updated on a latched single page basis.

Also in the tower cab, collocated with the Critical Display, will be the Supplementary Display. This shall be a small (9" diagonal) CRT type display consisting of 16 lines by 32 characters with local refresh and storage capability for up to 12 pages, with pages locally selectable via push buttons. This display shall provide important but non-critical information to the controller upon request. It shall also form the backup to the CD since one of the 12 pages of data available in local storage will contain the critical information. Updated data and alarm information shall be provided by the CPS on a page basis to the local storage in the display.

Also collocated with the CD in the tower cab will be the lighting control panel. This panel shall consist of push button switches to control power on/off and light levels for the airport lighting systems. This panel shall be under software control and the activation of any switch shall result in an interrupt to the CPS which shall generate the necessary command to the appropriate lighting system. Changes and reconfigurations involving runway assignments and lighting control responsibilities shall be possible from the SMD, as well as, the capability of controlling the lights shall also be possible from any of the SMD.

The TRACON display is to be located in the TRACON and shall have available on a page basis, some of the critical data as well as the capability of simultaneously displaying the noncritical data that will be available on the SD. This shall be a 16 line by 32 character gas discharge type display with local refresh and storage available for 12 pages, with pages locally selectable via push buttons. The first four lines on this display will normally display data similar to that on the first four lines of the critical display with supplementary data being provided on the remaining available lines. Updated data and alarm information shall be provided by the CPS on a page basis into local storage as it occurs.

The SMD, located in the tower cab and TRACON respectively, shall be the same as the CPS operator and maintenance supervisory display/terminals. These displays shall have the capability of displaying and refreshing one or two 16-line by 32 character pages simultaneously. Input command and page accessing capabilities from these positions shall be according to user ID and password when logging on the system.

Within the framework of the Phase I system, the Phase I design shall include provisions for the types of remote facilities monitoring subsystems as specified in Parts 4, 5, and 6 of the ER. Each subsystem is composed of remote sites with a facility processing unit (FPU) performing the monitoring functions. An FPU consists of a microprocessor and its associated memory, a data communications unit (modem), uninterruptable

power supply, and a status/control interface with all necessary sensors to
perform the monitoring and control functions of the RMM. Due to the field
locations of the navaid equipment, one FPU may perform the RMM functions on
multiple navaid equipment at a remote site. The remote FPU's/sensors with
signal characteristics (analog and digital) required to perform RMM shall
be procured in the Phase II system.

Certain data, when specified in the contract schedule, shall be processed
through FPUs, as identified in Part 7 of the ER. These FPUs shall be
located within the ATCT/TRACON rather than at a remote facility.

The initial design of the CCD/RMMS processing system shall include the
capability to expand the data acquisition functions and processing
capability as defined in Part 3.

1-.3.2 Reliability and Maintainability.- The reliability and
maintainability requirements for each of the equipments of the CCD/RMMS are
detailed in each part of the ER. The overall program plan shall be as
specified herein.

1-3.2.1 System Maintenance Approach.- The overall system maintenance
approach shall be to localize failures through the use of software and
hardware maintenance features and to replace the failed module, element, or
pluggable unit from spares. The actual repair of the replaced item shall
be accomplished off-line in a bench repair area. The mean bench repair
effort for any assembly, subassembly, module, or printed circuit board
shall not exceed 4.0 man hours and the maximum bench repair effort shall
not exceed 8.0 man hours. Maintenance philosophy guidelines will be issued
as part of the contract documentation.
Diagnostic software and maintenance features shall be designed to rapidly
isolate malfunctions to the replaceable module level. Where printed
circuit boards are used, the replaceable module shall be considered to be
the printed circuit board level.

The CCD/RMMS shall be designed to minimize the requirement for preventive
maintenance.

1-3.2.2 Reliability Program Plan.- The contractor shall prepare and
submit, for FAA approval, a plan to implement a reliability program
following the guidelines established in MIL-STD-785. The reliability
program and its management shall be a clearly identifiable organizational
element responsible for the effective execution of all reliability
requirements and efforts related thereto. However, it is the intent of the
government to establish a program which will include system reliability
modeling, reliability analysis, and failure reporting/analysis/corrective
action. A limited reliability demostration test shall be performed as
specified in paragraph 1.4.4.2 to validate the initial system in accordance
with the reliability model defined in paragraph 1-3.2.2.1(a). The
reliability plan shall be implemented and the results of the program shall
be documented in a reliability report.

1-3.2.2.1 Program Tasks.- The reliability program shall include the following tasks:

(a) Reliability modeling - The overall CCD/RMMS shall be reliability modeled. The model shall be of sufficient detail to identify critical paths or items whose failure will cause system or subsystem failure of degraded operation. The model shall be representative of the system's operational capability and all states including the degraded mode shall be clearly delineated. The minimum system shall be as follows:

(1) One of two processors.

(2) One of three Critical Displays.

(3) One of two either the CPS Operator Terminal or the Maintenance Supervisory Maintenance Display (SMD)

(4) One of three Supplemental Displays.

(5) One of three Lighting Control Panels.

(6) One of two Supervisory Maintenance Displays (SMD).

(7) Four of twelve TRACON Displays.

(8) One of two FPU's for the Tower Interface Subsystem.

(9) One of two disc units.

(b) Reliability analyses - Reliability analyses and predictions, including failure modes, effect, and analyses, shall be performed both during the preliminary system design phase and as a demostration of conformance to requirements prior to the final system design freeze. These analyses shall be detailed assessments of the design and conducted to a level sufficient to provide assurance that specified reliability criteria will be met. The methods of MIL-STD-756A shall be applied, using definitions of MIL-STD-721B and failure rate data from MIL-HDBK-217.

(c) Failure reporting, analysis, and corrective action - The contractor shall establish a system of failure reporting for both factory and on-site failures. The method of reporting shall be submitted for FAA approval.

(d) For purposes of reliability testing the CCD/RMM system and
subsystem shall be considered failed, if any of the following
occurs: (1) CCD/RMM fails to respond to any command, specified
herein or in any approved document generated to satisfy the
requirements of the contract, entered into the minimum system
(1-3.2.2.1(a)) in accordance with the accepted procedure, and (2)
CCD/RMM fails to output any message to the minimum system
(1-3.2.2.1(a)) for the conditions specified herein or in any
document generated to satisfy the requirements of the contract.

Failures occurring from the time the design is frozen until the installed
subsystem has been accepted shall be reported. The contractor shall
analyze each failure to ascertain its cause. Failure data reports to the
component levels, including individual and trend analysis results, shall be
maintained in a central file to which the FAA shall have full access.
Monthly summaries of all failures and their status shall be submitted to
the FAA as a part of the monthly progress report.

1-3.3 Design and Construction

1-3.3.1 General Hardware Requirements.- In general, the hardware will meet
the requirements in this paragraph, unless otherwise specified in other
parts of this E.R. The CCD/RMMS shall be designed to provide the
achievement of maximum performance, operational reliability and good
accessibility/maintainability for maintenance and repair or replacement of
units, components, and circuits. Each subassembly shall be removable from
the cabinets without requiring the partial or complete removal of any other
subassembly. It is the intent of the government to utilize off-the-shelf
equipment wherever possible. For assemblies, components, equipment, etc.
that is not off-the-shelf, the equipment shall conform to the requirements
of FAA-G-2100/1. Each item of off-the-shelf equipment shall conform to
those design and quality standards of its manufacturer in effect on the
closing date of the Request for Proposals and all requirements stated in
this E.R. The cabinets shall be of high quality, sturdy construction that
will withstand normal shipment and installation of the system.

All cables and wires, harnessed or single, shall be protected against
chafing, and such protection shall be independent of the individual wire or
cable insulation jacket. All surfaces of items on the front of panels
shall be at chassis ground potential. The various units or modules mounted
in each cabinet shall be accessible for servicing from either front or rear
unless otherwise specified in other parts of this ER. These units shall be
provided with slides where necessary to permit withdrawal for servicing,
and where components or test points are only accessible from the bottom, a
suitable tilt or hinge arrangement shall be provided to permit
accessibility. The hardware shall be designed so that all alignments,
adjustments and maintenance can be performed by only one technician. Any
replaceable unit, assembly, subassembly, etc. shall weigh no more than
50lbs.

1-3.3.1.1 Color and Texture of Finishes.- The finish of all exposed
covers, doors, shelves, etc., shall be baked vinyl base paint. Accent

(d) For purposes of reliability testing the CCD/RMM system and subsystem shall be considered failed, if any of the following occurs: (1) CCD/RMM fails to respond to any command, specified herein or in any approved document generated to satisfy the requirements of the contract, entered into the minimum system (1-3.2.2.1(a)) in accordance with the accepted procedure, and (2) CCD/RMM fails to output any message to the minimum system (1-3.2.2.1(a)) for the conditions specified herein or in any document generated to satisfy the requirements of the contract.

Failures occurring from the time the design is frozen until the installed subsystem has been accepted shall be reported. The contractor shall analyze each failure to ascertain its cause. Failure data reports to the component levels, including individual and trend analysis results, shall be maintained in a central file to which the FAA shall have full access. Monthly summaries of all failures and their status shall be submitted to the FAA as a part of the monthly progress report.

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1-3.3.1 General Hardware Requirements.- In general, the hardware will meet the requirements in this paragraph, unless otherwise specified in other parts of this E.R. The CCD/RMMS shall be designed to provide the achievement of maximum performance, operational reliability and good accessibility/maintainability for maintenance and repair or replacement of units, components, and circuits. Each subassembly shall be removable from the cabinets without requiring the partial or complete removal of any other subassembly. It is the intent of the government to utilize off-the-shelf equipment wherever possible. For assemblies, components, equipment, etc. that is not off-the-shelf, the equipment shall conform to the requirements of FAA-G-2100/1. Each item of off-the-shelf equipment shall conform to those design and quality standards of its manufacturer in effect on the closing date of the Request for Proposals and all requirements stated in this E.R. The cabinets shall be of high quality, sturdy construction that will withstand normal shipment and installation of the system.

All cables and wires, harnessed or single, shall be protected against chafing, and such protection shall be independent of the individual wire or cable insulation jacket. All surfaces of items on the front of panels shall be at chassis ground potential. The various units or modules mounted in each cabinet shall be accessible for servicing from either front or rear unless otherwise specified in other parts of this ER. These units shall be provided with slides where necessary to permit withdrawal for servicing, and where components or test points are only accessible from the bottom, a suitable tilt or hinge arrangement shall be provided to permit accessibility. The hardware shall be designed so that all alignments, adjustments and maintenance can be performed by only one technician. Any replaceable unit, assembly, subassembly, etc. shall weigh no more than 50lbs.

1-3.3.1.1 Color and Texture of Finishes.- The finish of all exposed covers, doors, shelves, etc., shall be baked vinyl base paint. Accent

For any contractor developed systems, as compared to off-the-shelf products, the grounding design shall be in accordance with the guidelines defined in FAA-STD-020 paragraph 4 and 5. When system components are off-the-shelf or when industrial standards on the components require a redesign, these components will be part of the grounding design, as submitted with the proposal. The controlling factor in all the designs is personnel safety. The power ground will be available at each alternating current (AC) power distribution point provided in the equipment area.

The contractor shall be responsible for interfacing his system grounding with existing systems.

There shall be no degradation of signals between equipment due to cross-coupling through the ground system.

1-3.3.1.8 Conducted and Radiated Interference.- The equipment specified herein shall satisfy the basic limits of interference and susceptibility as specified in MIL-STD-461. Should any proposed equipment have been built to comply with a interference control specification other than MIL-STD-461 (e.g., MIL-I-16910), the FAA will accept that specification in lieu of MIL-STD-461 provided that the requirements of the two specifications are generally comparable.

1-3.3.1.9 Cables.-The contractor shall furnish all cables, cable connectors, terminal boards, etc., required for factory and site testing and installation of the equipment. This shall include any special purpose test cables or card extenders required for routine maintenance.

1-3.3.1.9.1 Cable Entrance and Exit Locations.- Cable entrances and exits shall be designed such as to enable advantageous routing of the cables between units from the standpoint of accessibility, noninterference with operating personnel, and appearance of installed equipment.

1-3.3.1.10 Components and Materials.- All subassemblies, components and materials shall be in accordance with FAA-G-2100/1 except for off-the-shelf equipment. Off-the-shelf equipment may employ components or materials not in accordance with FAA-G-2100 except that the interchangeability requirements of paragraph 1-3.14.3 of FAA-G-2100/1 shall apply.

1-3.3.1.11 Electrical Design.- The electrical design of the system shall minimize total electrical power consumption and be in accordance with best commercial practice. All contractor furnished racks shall have convenience twin outlets in accordance with 1-3.6.4 of FAA-G-2100/1 on the front and rear for 120-volt AC test equipment, soldering irons, etc. These outlets shall be powered from an electrically separate power cable brought out of the cabinet for connection to a separate noncritical AC power source. The ground terminal of all convenience outlets shall be electrically isolated from the equipment cabinet and connected by a green insulated conductor to the ground terminal in the power distribution panel serving the outlet.

1-3.3.1.12 Hardware Standardization.- Although not specifically mentioned elsewhere in this ER, for each FPU modem there shall be a corresponding modem at the cental site which will interface with the CPS. All modems

used in the system shall be of the same product line and the modems at the central site shall be printed circuit board type, pluggable into standard card cages for ease of expansion. It shall be the responsibility of the contractor to provide all modems required in the system.

All FPU microprocessors used in the system shall be of the same product line.

1-3.3.1.13 Safety.- To promote maximum safety of both operating and maintenance personnel, the precautions outlined in Requirement 1 of MIL-STD-454 shall be reviewed for adherence in the area of system design and construction.

1-3.3.1.14 Human Engineering.- Human engineering design criteria and principles shall be applied in the design to achieve safe, reliable, and effective performance by operator and maintenance personnel. Design criteria shall be in accordance with Requirement 62 of MIL-STD-454.

1-3.3.1.15 Motors.- Motors shall be designed for continuous duty and shall not exceed 1800 RPM except for off-the-shelf equipment. Motors shall have best quality anti-friction bearings that shall not require lubrication more often than once every 8,000 hours of operation.

1-3.3.1.16 Service Life.- The system shall be designed and constructed to have a nominal service life of at least 20 years, operating 24 hours per day, seven days per week.

1-3.3.2 General Software Requirements.- All software (remote sites and CPS) developed and delivered by the contractor to perform the requirements of this specification, shall meet the following general requirements.

1-3.3.2.1 Modular.- The software shall be designed modularly, with each separate task being an individual module capable of being compiled and/or assembled independently. The addition, deletion, or modification of a task shall have a minimum effect on the remaining software.

1-3.3.2.2 Flexible.- The software shall provide flexibility to adapt to specific remote sites and display subsystem configurations and requirements. The addition, deletion, modification of remote site parameters to be monitored or the number and types of displays and display/terminals in the display subsystem shall have little or no effect on the software.

1-3.3.2.3 Defensive.- The software shall be designed defensively, with the communications software validating all messages and the command processing software validating all commands. An invalid message or command shall not hinder the performance of an FPU or the CPS. An inoperative FPU or a CPS single processor and/or peripheral failure shall not degrade the performance of the remaining system.

1-3.3.2.4 Standardization.- The software shall be written in the Fortran IV programming language, to the maximum extent possible, and must conform

to the specifications for the American National Standard Fortran (ANSI X3.9-1966). Man-computer communications, such as commands (input formats), error messages, and output data formats shall be standardized within each CCD/RMMS subsystem.

1-3.4 Documentation.- Documentation furnished under the contract shall be as specified in the following paragraphs and in the other parts of the ER. Documentation detailed under this part of the ER applies to all parts of the CCD/RMMS while the documentation detailed in each part of the ER applies to that subsystem only.

The contractor may utilize existing material or material that may contain the required information within an existing document. Submission and approval of documentation material shall be in the quantities and be in accordance with the schedule specified in the contract. Updating of the required documentation shall be accomplished periodically to maintain the documentation in current status so that upon completion of the contract, the final documentation is consistent with the delivered system. The contractor shall provide all documentation necessary for the FAA to maintain and modify all deliverable hardware and software.

1-3.4.1 System Design Data.- Preliminary design data shall be prepared and submitted for review and approval in accordance with the contract schedule. This preliminary data shall include all elements of the equipment to be supplied by the contractor under the terms of the contract, as detailed by these requirements and any addenda thereto, together with all interfaces with other equipments. As a minimum, it shall include the system description, block and data flow diagrams, basic interfacing, and basic mechanical/electrical requirements. The preliminary design data and any approved modification/clarification to the preliminary design data shall be submitted as a draft in accordance with the contract schedule for review and approval. F nal design data shall be developed and submitted for review and appro al as the design of various elements is completed. Upon completion of all design work, a final system design data package shall be provided. The system design data submissions shall be organized to reflect the hardware design approach. All pages shall be sequentially numbered. This submission of system design data shall not be used to produce modifications or alternatives to details of this specification. Approval of the design data shall not relieve the contractor from his obligation to meet all contract requirements.

1-3.4.1.1 System Description.- The preliminary, draft and final system design data shall include a description of the system and each element detailing the interaction and operational capabilities necessary to meet functional requirements.

1-3.4.1.2 Block and Data Flow Diagrams.- A set of equipment block and data flow diagrams shall be provided in the preliminary, draft and final system design data. The diagrams shall show the general operational and logic relationships of the equipment elements.

1-3.4.1.3 Logic Diagrams.- The contractor shall provide complete equipment logic diagrams for all equipment supplied (off-the-shelf and designed

equipment) as a part of the final system design data. **Symbology** used in these diagrams shall be fully explained in the design data.

1-3.4.1.4 Input/Output Details.- In the preliminary, draft and final design data, the contractor shall provide data which consolidates all equipment interfaces and input/output characteristics. These details shall include signal characteristics and limits, and loading requirements. This data shall include major internal as well as external interfaces.

1-3.4.1.5 Mechanical/Electrical Requirements.- Both the preliminary, draft and final system design data shall include sufficient drawings and text to provide a description and tolerances of major and critical dimensions, routing of cables, mechanical assemblies, and other features such as cable entry and exit, control, and maintenance panels. Power requirements shall also be provided.

1-3.4.2 Software Design **Data.-** This design documentation shall provide overall information about the **CCD/RMMS** software and shall include, as a minimum, a functional specification and design specification for each subsystem as described in the following paragraphs. This documentation shall contain a subsystem description, external and internal data formats, man-machine interface commands , partitioning of functional requirements, and other details such as memory storage requirements, etc., for each subsystem.

The preliminary data shall be prepared and submitted for review and approval in accordance with the contract schedule. The preliminary design data and any approved modification/clarification to the preliminary design data shall be submitted as a draft in accordance with the contract schedule for review and approval. Upon completion and **approval** by the government of all software design work, a final design data package shall be provided in accordance with the contract schedule.

1-3.4.2.1 Software Functional Specifications.- For each subsystem, a functional specification shall be prepared and delivered to the government in accordance with the contract schedule. These specifications shall include, but not be limited to, the elements cited below.

1-3.4.2.1.1 General **Description.-** Provide an overall description of the operational (application) requirements in terms of inputs, outputs, and the algorithms to be used to determine the outputs as a function of the inputs. A list of functions to be performed by the subsystem and **a** block diagram of the hardware/software system shall be included. Operational Requirements for Entry, Display and Display Information Processing are contained in Appendix 2 as functional **demonstratable** units and in conjunction with other functions identified throughout the **ER** define the **CCD/RMMS** system.

1-3.4.2.1.2 Detailed Functional Description.- Provide a detailed description of each function that must be performed. This description shall include the operational requirements, as defined in Appendix **2, CPS** requirements as defined in Part 3 and other functions not specifically specified that are required for system operation and integrity. As a minimum the detailed functional description shall include the following:

equipment) as a part of the final system design data. **Symbology** used in these diagrams shall be fully explained in the design data.

1-3.4.1.4 Input/Output Details.- In the preliminary, draft and final design data, the contractor shall provide data which consolidates all equipment interfaces and input/output characteristics. These details shall include signal characteristics and limits, and loading requirements. This data shall include major internal as well as external interfaces.

1-3.4.1.5 Mechanical/Electrical Requirements.- Both the preliminary, draft and final system design data shall include sufficient drawings and text to provide a description and tolerances of major and critical dimensions, routing of cables, mechanical assemblies, and other features such as cable entry and exit, control, and maintenance panels. Power requirements shall also be provided.

1-3.4.2 Software Design **Data.-** This design documentation shall provide overall information about the **CCD/RMMS** software and shall include, as a minimum, a functional specification and design specification for each subsystem as described in the following paragraphs. This documentation shall contain a subsystem description, external and internal data formats, man-machine interface commands , partitioning of functional requirements, and other details such as memory storage requirements, etc., for each subsystem.

The preliminary data shall be prepared and submitted for review and approval in accordance with the contract schedule. The preliminary design data and any approved modification/clarification to the preliminary design data shall be submitted as a draft in accordance with the contract schedule for review and approval. Upon completion and **approval** by the government of all software design work, a final design data package shall be provided in accordance with the contract schedule.

1-3.4.2.1 Software Functional Specifications.- For each subsystem, a functional specification shall be prepared and delivered to the government in accordance with the contract schedule. These specifications shall include, but not be limited to, the elements cited below.

1-3.4.2.1.1 General **Description.-** Provide an overall description of the operational (application) requirements in terms of inputs, outputs, and the algorithms to be used to determine the outputs as a function of the inputs. A list of functions to be performed by the subsystem and **a** block diagram of the hardware/software system shall be included. Operational Requirements for Entry, Display and Display Information Processing are contained in Appendix 2 as functional **demonstratable** units and in conjunction with other functions identified throughout the **ER** define the **CCD/RMMS** system.

1-3.4.2.1.2 Detailed Functional Description.- Provide a detailed description of each function that must be performed. This description shall include the operational requirements, as defined in Appendix **2, CPS** requirements as defined in Part 3 and other functions not specifically specified that are required for system operation and integrity. As a minimum the detailed functional description shall include the following:

(c) External Communications - Describe the module input and output in terms of control (sequence) and data. External data structure shall be included.

(d) Subroutines and Tasks Called - List subroutines and tasks (with priority level) called to perform the required functions.

(e) Module test plan - Cite the plan for unit testing the module to insure specifications are met.

1-3.4.2.2.4 Memory Management.- Describe any special techniques required for memory management, such as overlays, re-entrant subroutines, etc.

1-3.4.2.2.5 Nucleus System (CPS only).- The nucleus system shall consist of those modules required to input and format data from the remote sites and output this data to the appropriate displays. Describe the plan for integrating and testing the nucleus system, including routines used to simulate other software components.

1-3.4.2.2.6 Staging and Integration Plan.- Specify the order in which modules will be integrated. An integrated plan of operational and functional routines shall be described that will include the requirements identified in paragraph 1-3.4.2.1.2.

1-3.4.2.2.7 Acceptance Criteria.- Specify acceptance criteria for each subsystem.

1-3.4.3 Instruction Manual.- Instruction manuals shall be provided on all parts of the CCD/RMMS. As a minimum, the manuals shall include the following:

1-3.4.3.1 Table of Contents

1-3.4.3.2 General Description.- Brief description of the equipment including the general mechanical construction and the basic principles upon which it operates. Characteristics of power requirement, list of equipment units or major assemblies, list of detachable accessories furnished, weight and overall dimensions of each unit of equipment.

1-3.4.3.3 Theory of Operation.- Description of the circuits of the equipment and their operation, explaining unusual or new circuit arrangements and special circuits. Functional block diagrams, simplified logics, flow diagrams, and simplified or partial schematics shall be employed where they will clarify text.

1-3.4.3.4 Installation.- Instructions for installing and interconnecting the various units; power source requirements, connections, and recommended size of circuit breakers, initial adjustments to place equipment in operation.

1-3.4.3.5 Operations.- Outline of the functional operating procedure, including step-by-step instructions for starting and operating equipment.

Key performance parameters shall mean those parameters (hardware, software) that confirm the functional and operational status/availability of the CCD/RMM system.

1-3.4.3.6 Preventive Maintenance.- Include all maintenance procedures and adjustments which should be performed periodically by technicians for the purpose of preventing failure or impairment of the equipment.

1-3.4.3.7 Corrective Maintenance Data.- Include information necessary to permit a technician to locate trouble and to make repairs or the necessary adjustments to the equipment.

1-3.4.3.8 Parts List.- All parts shall be fully identified to facilitate procurement of replacements. Cross-referencing of the contractor's part number to commercial equivalent parts shall be provided where applicable. Parts lists prepared under this contract shall be in accordance with paragraphs 3.6 and 3.8 of FAA-C-1210c.

1-3.4.3.9 Circuit Diagrams.- Diagrams shall include the following: cabling diagrams, wire lists, logic diagrams, and schematic diagrams. This section shall contain diagrams designed to facilitate the rapid isolation of troubles within the system.

Existing commercial manuals are acceptable provided the above items, as a minimum, are included. However, review and approval by the government is required prior to shipment.

1-3.4.4 Software Documentation.- The contractor shall provide all documentation necessary for FAA to maintain and modify all deliverable computer programs. The organization of all documentation shall be complete and conform to accepted program documentation practices. Where flow charts occur within the documentation, all symbols used shall conform to ANSI standards. The requirements for this documentation shall be as described in each part of the ER.

1-3.4.5 Installation Plan and Report.- The government will provide preliminary information on the existing physical resources 90 days from date of contract, covering items such as the proposed location of equipment, floor plan layouts, proposed cable routing, location of power, information on access restrictions, if any, and floor loading. The contractor shall provide an installation plan in report form to permit the FAA to prepare for system delivery, installation, and checkout in accordance with the contract schedule. As a minimum, the report shall contain the following information:

> (a) System block diagram with a short, narrative, general description of the functional capabilities and hardware subsystem.

> (b) Floor plan layouts for the equipment room. Information on equipment placement limitations, e.g., maximum distances between equipment comprising the system.

(c) Detailed physical description of the equipment including physical size, weight, clearance factors, ventilation requirements, cable entry, and exit features, etc.

(d) Cable and duct requirements. This section shall include such items as information on cable interconnection, requirements, cable connections to signal junction box, and quantity of cables to be used, etc.

(e) Power requirements. Information on size and type of power cabling to be used, type and size of required government-furnished power panels, etc. shall be included.

(f) Equipment grounding requirements shall be stated.

(g) Any other technical or general information that will be required to properly prepare a site for installation.

Upon completion of the installation, the contractor shall update the installation plan to represent the "as built" record.

1-3.4.6 Progress Reports.- Progress reports shall be submitted at monthly intervals. These reports shall include a concise statement of the work accomplished for the reporting period, and work scheduled for the forthcoming period; reliability failure data and analysis information; summary status of detailed 'design and tests of any deliverable item, a summary of any meetings between the contractor and others participating in the program; and special problem areas, including proposed solutions. An analysis of critical events and activities, such as critical path if PERT is used, shall be included. This type of report may be presented in letter form. The report shall include the title, type of report, contract number/project number, and release date.

1-3.5 Test Equipment

1-3.5.1 Special Tools and Test **Equipment.-** The term special tools and test equipment is defined as those tools and test equipment not carried as a standard line by the contractor or another manufacturer. All special tools and test equipment for test and maintenance of the system specified herein, not readily available on the open market such as alignment tools, testing devices, jigs, special purpose test cables, circuit card extenders, etc., shall be supplied with each system.

The contractor shall submit for government approval, a complete list of special tools and test equipment, the application of each, and the unit and/or component for which it is required. This shall be submitted prior to fabrication or procurement of any specialized tools and test equipment for use at government facilities. The design of the equipment shall be such as to permit the use of standard tools and test equipment insofar as practicable. Instruction manuals or booklets shall cover all special test equipment.

1-3.5.2 Standard Test **Equipment.-** The contractor shall provide a list of standard test equipment which will be required, as a minimum, to maintain the system, and the contractor shall provide the functional and performance characteristics of the test equipment in accordance with paragraph **3.13.1** of **FAA-G-1210c.**

1-3.6 Installation and **Checkout.-** The contractor shall perform installation and checkout of the system specified herein at the time and in the quantity and location specified in the contract. The contractor shall provide all services and equipment necessary for installation, integration, debugging, and checkout of the system.

1-3.6.1 Installation **Planning.-** The contractor shall conduct on-site inspection to become familiar with the environment that will be encountered during installation. Government representation will be available during these site **inspecitions** and access to the facilities will be arranged by the government.

Available copies of drawings covering proposed floor spaces will be provided to the contractor prior to these inspections. The objective of these on-site inspections is to provide the contractor with an opportunity to gather firsthand information to be used in the preparation of the installation plan (paragraph **1.3.4.5).**

1-3.6.2 Installation **Equipment.-** The contractor shall provide all **intra-unit** cables to permit installation of the various subsystems in the locations specified in the contract.

1-4 Quality Assurance Provisions

1-4.1 General **Requirements.-** The contractor shall provide and maintain a quality control program in accordance with **FAA-STD-013A.** The contractor shall provide and maintain a software quality control program in accordance with **FAA-STD-018.** The contractor's quality assurance program shall be a scheduled and disciplined plan of events integrating all necessary inspections and tests required to substantiate product quality during design, development, fabrication, assembly, acceptance, and shipping. The contractor shall provide and maintain measuring and testing devices in accordance with paragraph **1-4.4** of **FAA-G-2100/1.** The Government reserves the right to witness or perform any of the tests which are deemed necessary by the Government to assure that supplies and services conform to the prescribed requirements. The contractor shall furnish test specifications which shall detail the time , place, and manner in which the equipment shall be tested, according to test methods and procedures stated in the Government approved test plan.

The **CCD/RMM** system shall be tested to demonstrate compliance with the following paragraphs, **2-3.1** through **2-3.6, 3-3.1** through **3-3.7** and **7-3.1** through **7-3.4.**

During all tests, the monitoring circuits shall be verified by the use of external signals as listed in the contract schedule. Equipment will be

available at the FAA field site when required for site tests. The error
and alarm limits, nominal monitoring values, gray zones, and alarm
integration adjustments shall be verified by adjusting the equipment output
signals to cause alarms for all parameters. Erroneous alarms shall not
occur during the testing and the equipment shall automatically fail the
test if erroneous alarms are generated.

1-4.2 Test Plans, Procedures and Reports

1-4.2.1 Test Plan.- The contractor shall prepare and submit, in draft
form, recommended test plans for both factory and on-site testing for
review and approval by the government. The objective of these plans shall
be to show how the contractor will demonstrate compliance as specified in
paragraph 1-4.1. The government will review, approve, and/or direct
necessary changes to the test plans in accordance with the contract
schedule. The contractor shall incorporate such directed changes and
resubmit the final test plan prior to any tests in 'accordance with the
contract schedule.

1-4.2.1.1 Test Plan Content.- The test plan shall be comprehensive,
including all details necessary to assure that test procedures and testing
will satisfactorily demonstrate equipment compliance with all functional,
operational, hardware, software and environmental requirements.

The test plan shall be organized in a logical building block form to assure
that each subassembly or function is tested prior to its involvement in the
higher level system tests. The DU's in Appendix 2 represents a sample of
this philosophy. At the Government's option, certified tests of any
equipment produced prior to this contract or off-the-shelf equipment may be
accepted in lieu of that part of the test plan for that equipment.

The test plans shall identify the accuracy, percent of allowable deviation
and parameters required of assemblies, subassemblies, printed circuit
boards in the CCD/RMM system as proposed.

The test plan shall include a verification of the system performance with a
full complement of deliverable equipment in the normal operating
configuration and a minimum of 10 simultaneous alarms shall not degrade
system performance as specified in other parts of this ER.

1-4.2.1.2 Test Plan Amendments.- If, during a test, the test methods or
parameters, as agreed to by the Government, are found to be inadequately
specified, they shall be amended and approval by the Government obtained.

1-4.2.2 Test Reports.- Upon conducting the applicable tests in accordance
with the approved test plans, the contractor shall record the results for
submission to the FAA. Each test report shall contain a complete
description of the test results and shall be certified and submitted for
FAA approval after completion of each major test. Copies shall be
delivered to the FAA in accordance with the contract schedule.

1-4.2.3 Test Procedures.- Test procedures with identified methods and
detailed procedures, test setups, etc. shall be provided at least two

months prior to any scheduled tests. The two months will allow a sufficient period of time to review the subject procedures and incorporate any modifications.

These procedures shall verify the accuracy, percent of allowable deviation and parameters as specified in the test plans (1-4.2.1). Also, test procedures shall be developed to verify the factory and on-site tests as specified in paragraphs 1-4.4.1 and 1-4.4.2.

1-4.3 Factory Inspection.- Incoming and unit inspections and tests at the contractor's plant shall be performed by the contractor. The Government reserves the right to inspect and test components, materials and equipment to insure compliance with the contractor's quality assurance program. Copies of the contractor's quality assurance program test reports shall be provided upon request.

1-4.3.1 Incoming Inspection.- The Government may elect to make an incoming inspection of all or any portion of the components and materials used in construction of the equipment to determine compliance with the specifications covering that component/material.

1-4.3.2 Unit Inspection.- The Government may elect to make a unit inspection for units, such as, computer module, peripheral devices, keyboards, displays, etc., to determine compliance with the specifications covering each unit.

1-4.4 Testing.- The contractor shall be responsible for the performance of all factory and on-site tests in accordance with the test plans and test procedures (1-4.2) and the detailed tests in paragraphs 1-4.4.1, 1-4.4.2 and 1-4.4.3. Except as otherwise specified, the contractor may use his own or any other test facilities and services acceptable to the Government. Records of tests, including examinations and inspections, shall be kept complete and available to the Government as required by the contract. The tests shall be conducted by the contractor to demonstrate compliance with the quality assurance provisions as specified in paragraph 1-4.1.

1-4.4.1 Factory Tests.- The following tests shall be performed in the factory.

1-4.4.1.1 Form and Fit Test.- The physical, electrical and mechanical specifications for the Critical Display (2-3.3.1), Supplemental Display (2-3.3.2), TRACON Display (2-3.3.3) and Lighting Control Panel (2-3.3.5) shall be verified for compliance.

1-4.4.1.2 Environmental Test.- For off-the-shelf equipment, satisfactory performance in the operating environment (3-3.6.9), in the absence of specific evidence of a potential problem, will be considered as meeting the environmental requirements specified herein. Custom designed, fabricated, and/or packaged equipment shall be tested to verify compliance with the environmental requirements specified in this E.R.

1-4.4.1.3 **Burn-In-Test.**- To insure factory acceptance testing immediately prior to the factory acceptance tests, the equipment to be tested under the factory acceptance test shall have been operated at least **40** hours under room ambient conditions **(3-3.6.9).**

1-**4.4.1.4** Factory Acceptance **Test.-** Immediately following the **40-hour** "burn in" test, a factory acceptance test shall be conducted to verify system performance by cycling through the **DU's** in Appendix 2 and the other functional unit as defined in paragraphs **1-3.4.2.1.1** and **1-3.4.2.1.2.** In addition, the factory acceptance test shall be conducted with a full complement of deliverable equipment at an operational system saturation level under room ambient conditions **(3-3.6.9).** Operational system saturation level shall mean 'the system shall be exercised under the following simultaneous load conditions:
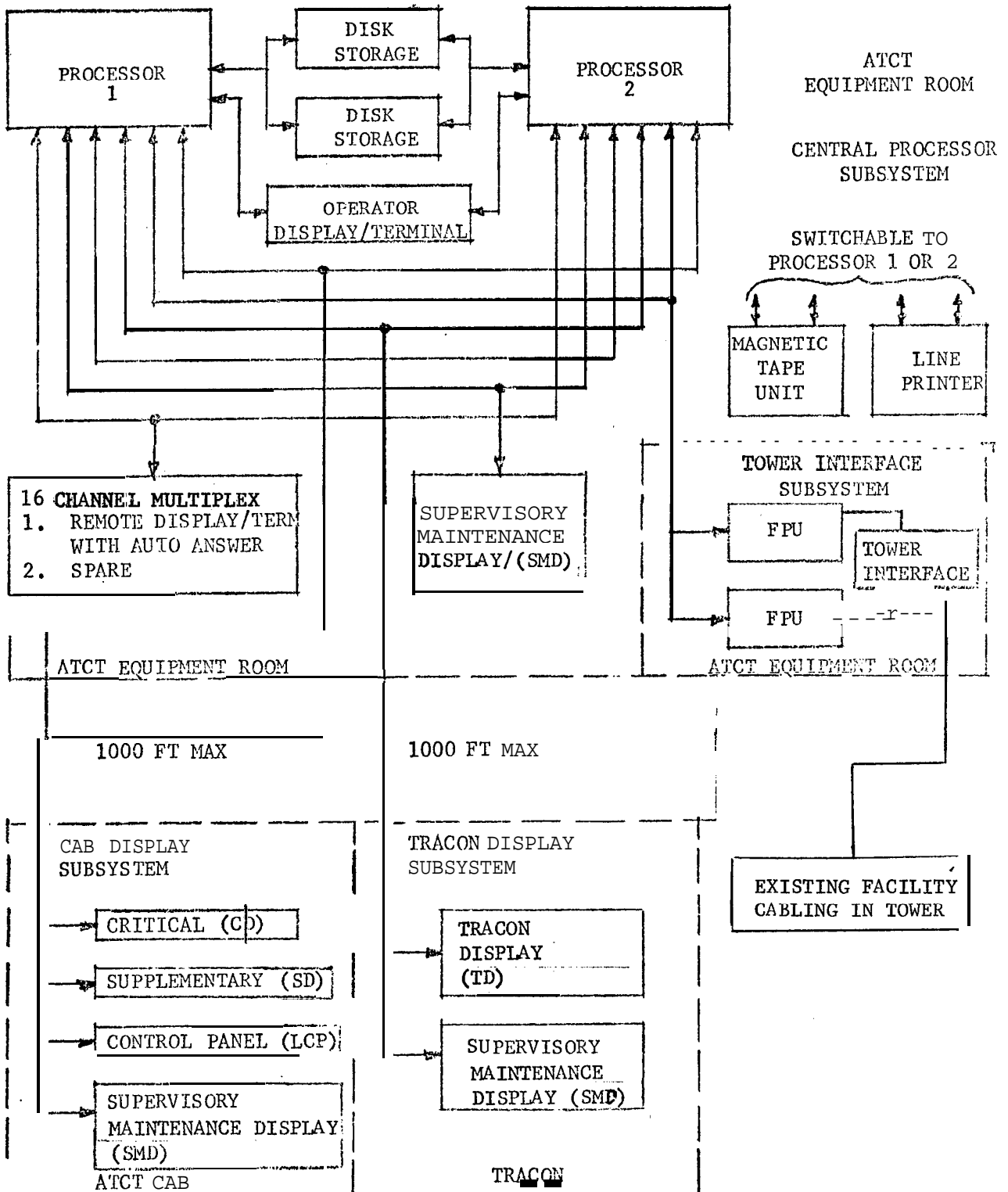
>   (a) All input signals to the demarcation box shall be provided
>   (simulated).

>   **(b)** All operational positions shall be exercised simultaneously
>   with the simulated data provided through item (a) and **(c).**

>   **(c)** Simulated data shall be varied to simulate real conditions, via
>   the demarcation box and manual data inputs.

>   **(d)** A minimum of ten **(10)** simultaneous alarms.

>   **(e)** Simultaneous running of the operational program and a support
>   (background) program.

The factory acceptance test shall demonstrate the functional hardware and software requirements as specified in paragraphs, **2-3.1** through **2-3.6, 3-3.1** through **3-3.7** and **7-3.1** through **7-3.4.**

1-**4.4.1.5** Reliability **Demonstration.-** The initial deliverable system shall be subjected to an extended operation to demonstrate reliability. The system shall be operated continuously with simulated input for **264** hours with no failure of displayed data during this period. In the first, middle and last **24** hour periods of the **264** hours, the contractor shall be required to cycle the system through the functional units defined in paragraphs **1-3.4.2.1.1** and **1-3.4.2.1.2.** The demonstration of the functional units shall be in accordance with approved test procedures. A failure of displayed data shall cause the contractor to conduct a failure analysis, redesign the equipment, if appropriate, and reinitiate the test at time zero. Failure of nondeliverable test facility equipment and/or environmental factors of the facility are not considered to be a system failure.

1-**4.4.2** On-Site Testing.- The contractor shall conduct tests at each site with the same test procedures as the factory acceptance test except the data inputs shall be live inputs at the demarcation signal box. Site parameters integration shall be performed by the contractor as specified in Appendix **2.**

1-**4.4.3** Additional **Tests.-** The FAA may require the contractor to repeat tests, or portions thereof, if the original tests fail to demonstrate compliance with the **ER.**

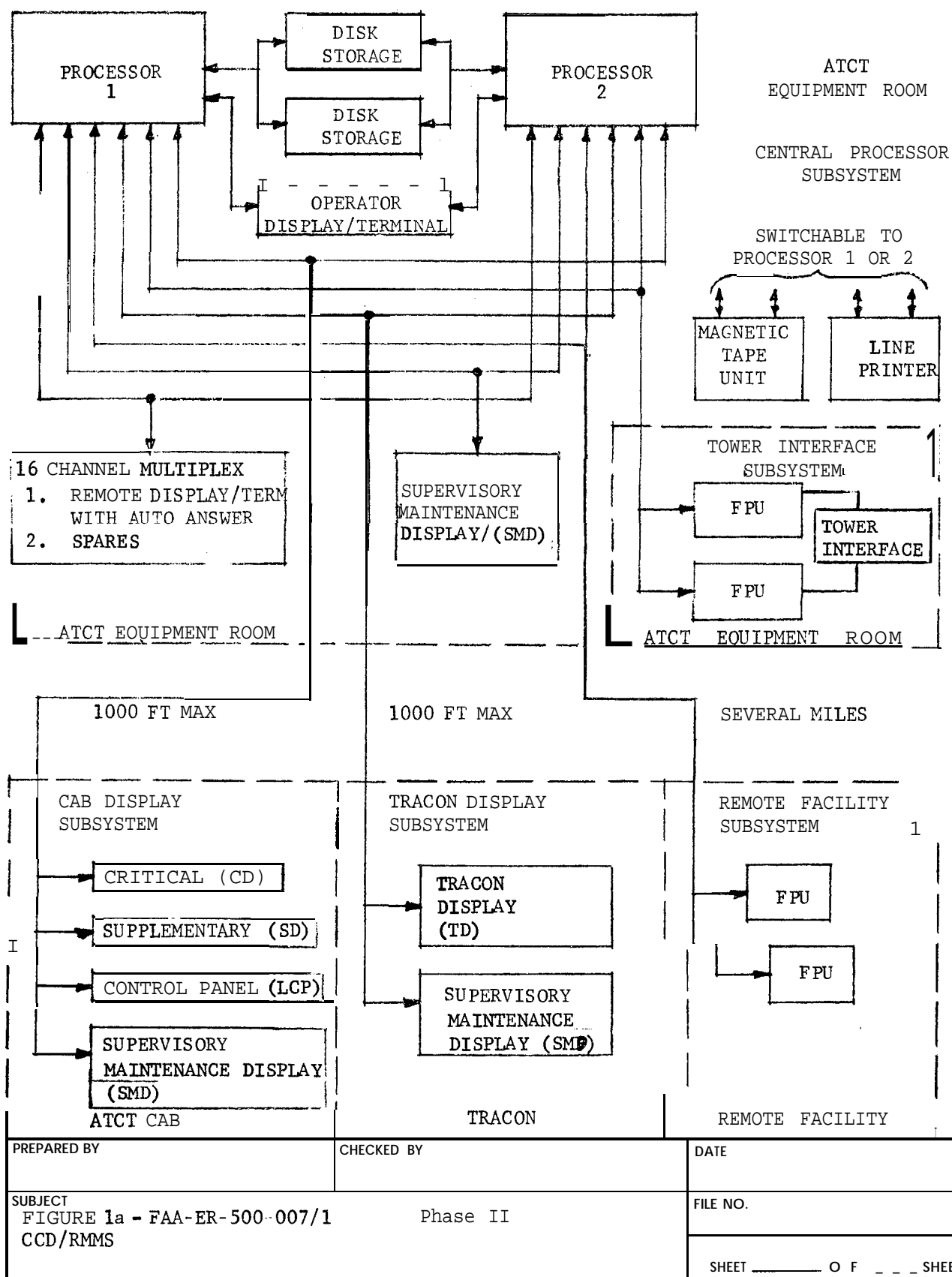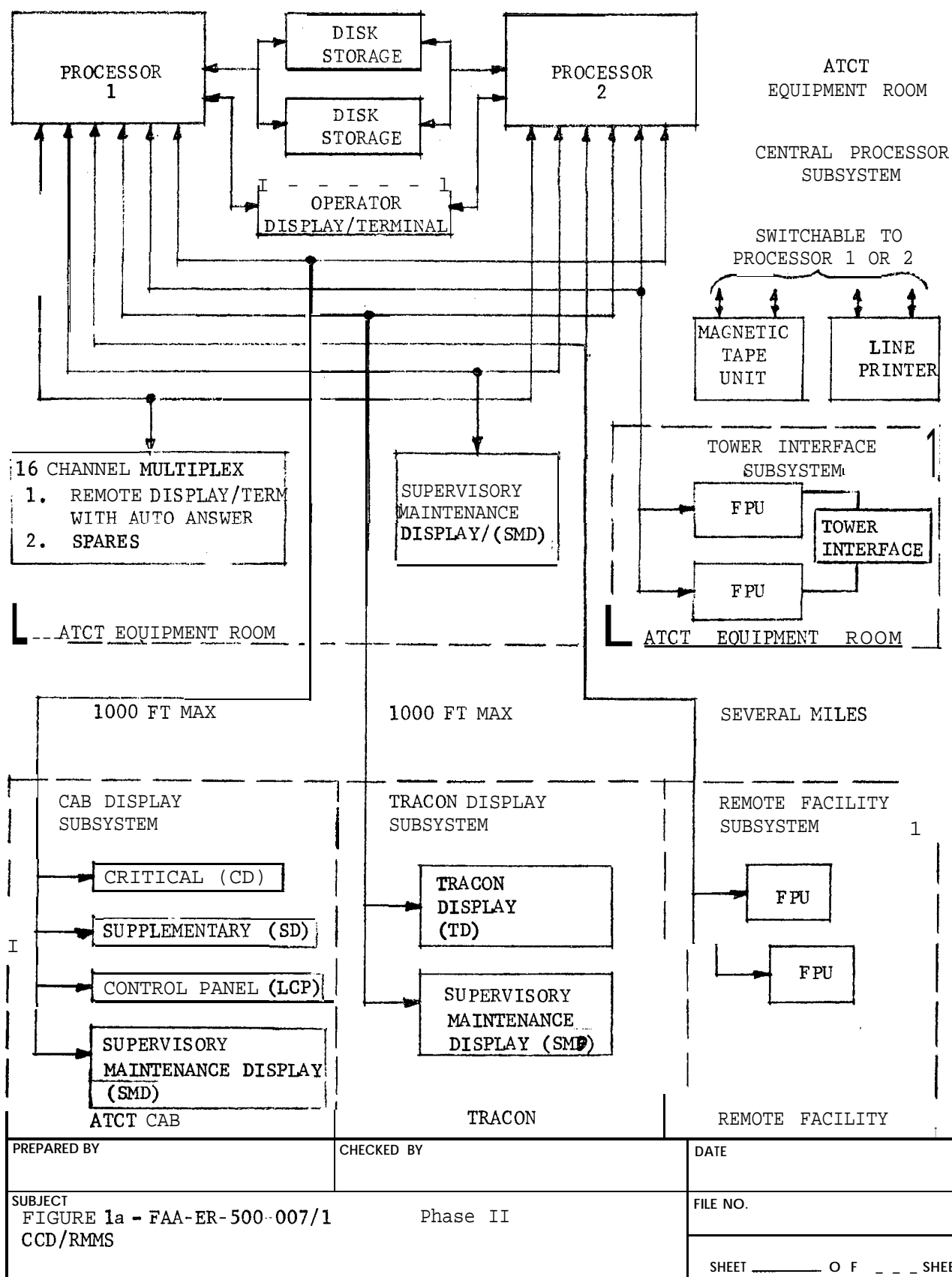1-4.4.1.3 **Burn-In-Test.-** To insure factory acceptance testing immediately prior to the factory acceptance tests, the equipment to be tested under the factory acceptance test shall have been operated at least **40** hours under room ambient conditions **(3-3.6.9).**

1-**4.4.1.4** Factory Acceptance **Test.-** Immediately following the **40-hour** "burn in" test, a factory acceptance test shall be conducted to verify system performance by cycling through the **DU's** in Appendix 2 and the other functional unit as defined in paragraphs **1-3.4.2.1.1** and **1-3.4.2.1.2.** In addition, the factory acceptance test shall be conducted with a full complement of deliverable equipment at an operational system saturation level under room ambient conditions **(3-3.6.9).** Operational system saturation level shall mean 'the system shall be exercised under the following simultaneous load conditions:

(a) All input signals to the demarcation box shall be provided (simulated).

(b) All operational positions shall be exercised simultaneously with the simulated data provided through item (a) and **(c).**

(c) Simulated data shall be varied to simulate real conditions, via the demarcation box and manual data inputs.

(d) A minimum of ten **(10)** simultaneous alarms.

(e) Simultaneous running of the operational program and a support (background) program.

The factory acceptance test shall demonstrate the functional hardware and software requirements as specified in paragraphs, **2-3.1** through **2-3.6, 3-3.1** through **3-3.7** and **7-3.1** through **7-3.4.**

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GPO : 1973 O - 500-866

FIGURE 1 - FAA-ER-500-007/1   PHASE I
CCD/RMMS

CALCULATION SHEET

FAA Form 6000-4 (4-73) FORMERLY FAA FORM 2067

FAA-ER-500-007/1

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┌──────────────┐     ┌──────────┐     ┌──────────────┐
│  PROCESSOR   │     │   DISK   │     │  PROCESSOR   │
│      1       │     │ STORAGE  │     │      2       │
│              │     ├──────────┤     │              │
│              │     │   DISK   │     │              │
└──────────────┘     │ STORAGE  │     └──────────────┘
                     └──────────┘
              ┌ ─ ─ ─ ─ ─ ─ ┐
              │   OPERATOR    │
              │DISPLAY/TERMINAL│
              └ ─ ─ ─ ─ ─ ─ ┘
```

ATCT
EQUIPMENT ROOM

CENTRAL PROCESSOR
SUBSYSTEM

SWITCHABLE TO
PROCESSOR 1 OR 2

```
┌──────────┐   ┌──────────┐
│ MAGNETIC │   │          │
│  TAPE    │   │  LINE    │
│  UNIT    │   │ PRINTER  │
└──────────┘   └──────────┘
```

┌ · · · · · · · · · · · · · ┐
│ 16 CHANNEL MULTIPLEX   │
│ 1. REMOTE DISPLAY/TERM   │
│   WITH AUTO ANSWER   │
│ 2. SPARES   │
└ · · · · · · · · · · · · · ┘

┌──────────────┐
│ SUPERVISORY │
│ MAINTENANCE │
│DISPLAY/(SMD) │
└──────────────┘

┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│   TOWER INTERFACE   │
│   SUBSYSTEM   │
│   ┌───────┐   │
│   │ FPU │──┐   │
│   └───────┘ │ ┌────────┐ │
│   │ │ TOWER │ │
│   ┌───────┐ │ │INTERFACE│ │
│   │ FPU │──┘ └────────┘ │
│   └───────┘   │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘

└── ATCT EQUIPMENT ROOM   └── ATCT   EQUIPMENT   ROOM

1000 FT MAX   1000 FT MAX   SEVERAL MILES

┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐ ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐   REMOTE FACILITY
│ CAB DISPLAY   │ │ TRACON DISPLAY   │   SUBSYSTEM   1
│ SUBSYSTEM   │ │ SUBSYSTEM   │
│   │ │   │   ┌───────┐
│ ┌──────────────┐   │ │ ┌──────────┐   │   │ FPU │
│ │ CRITICAL (CD)│   │ │ │ TRACON   │   │   └───────┘
│ └──────────────┘   │ │ │ DISPLAY │   │
│ ┌──────────────┐   │ │ │ (TD)   │   │   ┌───────┐
│ │SUPPLEMENTARY(SD)│ │ │ └──────────┘   │   │ FPU │
│ └──────────────┘   │ │   │   └───────┘
│ ┌──────────────┐   │ │ ┌──────────┐   │
│ │CONTROL PANEL(LCP)│ │ │SUPERVISORY│   │
│ └──────────────┘   │ │ │MAINTENANCE│   │
│ ┌──────────────┐   │ │ │DISPLAY(SMD)│   │
│ │ SUPERVISORY │   │ │ └──────────┘   │
│ │MAINTENANCE DISPLAY│ │   │
│ │   (SMD)   │   │ │   │
│ └──────────────┘   │ │   │
│   ATCT CAB   │ │   TRACON   │   REMOTE FACILITY
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘ └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
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| PREPARED BY | CHECKED BY | DATE |
|---|---|---|

| SUBJECT | | FILE NO. |
|---|---|---|
| FIGURE 1a – FAA-ER-500-007/1   Phase II  CCD/RMMS | | |
| | | SHEET _____ O F _ _ _ SHEETS |

FAA Form 6000—4 (4—73) FORMERLY FAA FORM 2067     CALCULATION SHEET

GPO : 1973 O - 500-866



| PROCESSOR 1 | DISK STORAGE | PROCESSOR 2 |
| DISK STORAGE |

OPERATOR DISPLAY/TERMINAL

ATCT
EQUIPMENT ROOM

CENTRAL PROCESSOR
SUBSYSTEM

SWITCHABLE TO
PROCESSOR 1 OR 2

MAGNETIC TAPE UNIT

LINE PRINTER

16 CHANNEL MULTIPLEX
1. REMOTE DISPLAY/TERM
   WITH AUTO ANSWER
2. SPARES

SUPERVISORY MAINTENANCE DISPLAY/(SMD)

TOWER INTERFACE SUBSYSTEM
FPU
TOWER INTERFACE
FPU

ATCT EQUIPMENT ROOM

ATCT EQUIPMENT ROOM

1000 FT MAX

1000 FT MAX

SEVERAL MILES

CAB DISPLAY SUBSYSTEM

CRITICAL (CD)

SUPPLEMENTARY (SD)

CONTROL PANEL (LCP)

SUPERVISORY MAINTENANCE DISPLAY (SMD)

ATCT CAB

TRACON DISPLAY SUBSYSTEM

TRACON DISPLAY (TD)

SUPERVISORY MAINTENANCE DISPLAY (SMD)

TRACON

REMOTE FACILITY SUBSYSTEM

FPU

FPU

REMOTE FACILITY

| PREPARED BY | CHECKED BY | DATE |
| SUBJECT FIGURE 1a - FAA-ER-500-007/1 Phase II CCD/RMMS | | FILE NO. |
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FAA Form 6000-4 (4-73) FORMERLY FAA FORM 2067        CALCULATION SHEET

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APPENDIX <u>**1-2**</u>

<u>CONSOLIDATED  CAR  DISPLAY/REMOTE</u>
<u>MAINTENANCE  MONITOR  SYSTEM</u>

**1-20** The Operational Requirements for Entry, Display, and Display
Information  Processing

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## 1-20.1 INTRODUCTION

**1-20.1.1  Purpose.-** This Detailed Operational Specification (DOS) defines the functions needed for the Consolidated Tower Cab, **TRACON,** and Remote Maintenance Monitor **(RMM).**  These functions are grouped into demonstrable units and defined in detail.

**1-20.1.2  Scope.-** This DOS specifies precisely the display and operator action functions and those functions needed to support the display and operator action functions up to the hardware interface with the sensor. It does not address the operation of the sensors or of the firmware for software of any microprocessor controlling the sensors.  This specification contains detailed functional capabilities described as precise operator input, display outputs, and algorithm behavior, including error conditions and outputs.  These functions are grouped into demonstrable units, and the order of development of the demonstrable units is identified.  This DOS contains sufficiently detailed information to serve as a source for training manuals.

**1-20.1.3** Background.- The **ATC** tower controls aircraft in the vicinity of an airport.  An **ATC** tower's function is divided into two major portions, the visual control of aircraft in the tower cab and the radar control of aircraft in the **TRACON.**  The purpose of this system is to consolidate the control and displays of many airport instruments and lighting currently spread over the tower cab into a critical display, supplementary display, and lighting control panel at the operational positions in the tower cab and to disseminate aviation oriented information to both the tower cab and **TRACON** positions.

**1-20.1.3.1** Position **Description.-** There are several types of positions in the typical tower cab:

> Local Controller
> Ground Controller
> Clearance Delivery
> Flight Data
> Cab Coordinator
> Tower Cab Supervisor

The maintenance position has a separate display located elsewhere. In addition, some tower cabs have a **skywatch** position.

Depending upon the air traffic activity, the tower cab team may consist of as few as one person or as many as needed to fill the positions listed and additional special positions.

Local **Controller.-** The local controller controls aircraft on final approach, touchdown, taxing on the runways, and departing.

Ground **Controller.-** The ground controller controls aircraft and ground vehicles on the **taxiways** and ramps.

Clearance **Delivery.-** Clearance delivery reads back to the pilot Instrument Flight Rules **(IFR)** clearances received from the National Airspace System **(NAS),** provides Visual Flight Rules **(VFR)** clearances and coordinates departures with Terminal Radar Control **(TRACON).**

Flight **Data.-** Flight data processes clearances, operates the **FDEP** and sets up flight progress strips for clearance delivery.

Cab **Coordinator.-** Cab coordinator coordinates with **TRACON** for departures and prepares arrival flight progress strips in support of local and ground controllers.

Tower Cab **Supervisor.-** The tower cab supervisor responds to outages, determines and distributes weather information within the cab and (via Automated Terminal Information System **(ATIS)** recordings) to pilots, performs coordination with other air traffic control organizations, and non-air traffic control organizations, and supervises cab operations.

Sky **Watch.-** Controls helicopters and fixed wing aircraft providing metropolitan area road traffic reports for radio and TV stations during rush hours.

Maintenance **Engineer.-** The maintenance engineer supervises the maintenance of the field sensors, field equipment, tower cab displays and related equipment, and the central computer system.

The types of positions in the typical **TRACON** are:

Approach Controller
Final Controller
Departure Controller
Terminal Controller
Terminal Data
Departure Data
**TRACON** Coordinator
**TRACON** Supervisor

Local **Controller.-** The local controller controls aircraft on final approach, touchdown, taxing on the runways, and departing.

Ground **Controller.-** The ground controller controls aircraft and ground vehicles on the **taxiways** and ramps.

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Approach Controller
Final Controller
Departure Controller
Terminal Controller
Terminal Data
Departure Data
**TRACON** Coordinator
**TRACON** Supervisor

be changeable by the users.  All other display data pages can be changed, added, or deleted.  Display data pages are defined by a user specifying the location of previously defined data elements within the data page area. The data elements are defined by the user in terms of size (in characters) and contents or source of contents.  Once the appropriate data pages are defined, the contents shall be updated by software from incoming messages and operator inputs and the data pages may be displayed upon user request on the appropriate displays.

Lights can be controlled via buttons associated with indicators at controller positions.

1-20.1.5 Functional Capabilities.- The functional capabilities specified in this section shall be available at a number of physical positions. In the control tower, there are a number of controller positions.  Each shall contain a "critical display (CD)" which shall present data which must be available on a continuous basis due to frequency of reference or must be displayed instantaneously due to urgency. Each also shall contain a "supplementary display (SD)" which shall present non-critical data on request.  In the TRACON there are a number of combined displays.  "TRACON Display (TD)" contains some of the data which is on the critical displays as well as the capability of simultaneously presenting non-critical data similar to that available to the tower controllers.  There are "supervisory/maintenance displays (SMD)" with a CRT and alphanumeric keyboard in the tower and TRACON for supervisory use and similar displays in the equipment area for use by maintenance personnel and the CPS operator. See Figure 1-20-1 for function summary.

1-20.1.5.1 Define/Modify Data Element.- An SMD operator shall be provided the capability to define or modify a data element description within the system.  Data elements shall be grouped into data element families. A data element shall be uniquely identified by its family name and its Member name.  A family shall be defined by a mnemonic name and a list of attributes.  A Member shall be defined by a mnemonic name and an optional list of attributes overriding those in the family definition.

Data elements shall be divided into two categories.  The first category includes those data elements that are input by software modules, e.g., aviation weather.  The capability shall be provided to add or delete data elements of these families.  The second cateogory includes those data element families that are not input by software modules, but are defined exclusively by an SMD operator.

FUNCTION SUMMARY
(But Not All Inclusive)

Define/Modify Data Element

Edit/Modify Contents of Data Element

Define/Modify Page

Supplementary Display Assignment

Display:

       Time
       Barometric Pressure
       Center Field Wind
       Assigned Runway Data
       **ATIS** Character

**Suface** Wind Observations

Change of Data Alert Display

Surface Wind Display

Request Runway Visual Range Alarm

Log On/Log Off

Entry of Adaptation Data

Assign Runways

Configuration Control

Display Supplementary Pages

Acknowledgment

Control:

       Time
       Center Field Wind
       **VAS** Separation Distance
       Runway Alert
       Airport Lighting

FUNCTION SUMMARY
(But Not All Inclusive)

Define/Modify Data Element

Edit/Modify Contents of Data Element

Define/Modify Page

Supplementary Display Assignment

Display:

        Time
        Barometric Pressure
        Center Field Wind
        Assigned Runway Data
        ATIS Character

Suface Wind Observations

Change of Data Alert Display

Surface Wind Display

Request Runway Visual Range Alarm

Log On/Log Off

Entry of Adaptation Data

Assign Runways

Configuration Control

Display Supplementary Pages

Acknowledgment

Control:

        Time
        Center Field Wind
        VAS Separation Distance
        Runway Alert
        Airport Lighting

**1-20.1.5.2** Edit/Modify the Contents of Data Element.- An SMD operator shall be provided the capability to display and then edit or modify the content of any data element in the data base.

**1-20.1.5.3** Define/Modify Page.- An SMD operator shall be provided the capability to define up to a maximum of 256 data pages. A page is defined by naming the data elements to be displayed and using the cursor to indicate their location on the page. Capability shall include defining the page size. The SMD operator shall have the capability to specify for each data element that new data shall cause the data element to blink, reverse video or shall cause an alert or alarm to be given. Space where no data elements can be specified shall be reserved on each page for a dedicated alert field.

**1-20.1.5.4** Supplementary Display Assignment.- An SMD operator shall have the capability to assign up to 12 previously defined pages to each position adapted for a specific tower.

**1-20.1.5.5** Display Time Function.- The critical display, backup critical display data page, and the critical portion of the TRACON display shall contain the time of day.

**1-20.1.5.6** Display Barometric Pressure Function.- The critical display, backup critical display, data page, and the critical portion of the TRACON display shall contain the current barometric pressure in inches of mercury.

**1-20.1.5.7** Display Center Field Wind Function.- The critical display, backup critical display data page, and the critical portion of the TRACON display shall contain the center field wind direction speed and gust speed.

**1-20.1.5.8** Display Assigned Runway Data Function.- The critical displays, backup CD data pages, and the critical portion of the TRACON displays shall contain, for each runway assigned to a controller position, the runway assigned, the Vortex Advisory System (VAS) separation distance, Runway Visual Range (RVR), and supplementary data character for each RVR, observed runway lights intensity state (from 3 through 5), and the following status data:

        ILS:  Glide Slope
              Localizer
              Inner Marker
              Middle Marker
              Outer Marker

ILS:  Backup,  same as above

ALS/MALS

SFL

when these equipments are sensed to be out.

1-20.1.5.9 Display **ATIS** Character Function.- The critical displays, backup CD data pages, and the critical portion of the **TRACON** displays shall contain the Automated Terminal Information System **(ATIS)** character.  This information will be entered by an **SMD** operator.

1-20.1.5.10 Surface Observations **(SA).-** The critical displays shall contain the surface observation data for the local facility.

1-20.1.5.11 Change of Data Alert Display - Surface Wind Display.- When the boundary surface wind on an airport boundary deviates from the center wind by a specified amount (specified in the **LLWSAS),** the boundary wind direction and speed shall be displayed blinking on all critical displays to allow immediate alerting of surface wind information.  When status data or surface observation data changes, the data shall blink on each critical display and on the critical portion of each **TRACON** display until acknowledged by the individual controller.

The capability shall be provided for a tower controller to request a surface wind at a specified boundary be displayed.  The wind direction and speed shall be displayed as in the Change of Data Alert Display.  There shall be buttons dedicated to requesting the display of wind at various boundaries.  This allows the tower controller to monitor the wind at boundaries even if they do not exceed the alarm threshold.

1-20.1.5.12 Request Runway Visual Range Alarm.- The capability shall be provided for a tower controller to specify an alarm Runway Visual Range **(RVR)** threshold for each of the three **RVRs** for each runway assigned to him using controls on his console.  Each control shall specify a valid **RVR** value for one of the **RVRs** on one of the runways assigned to the controller. The alarm thresholds shall be displayed and may be changed by the controller to increase or decrease the threshold.  When an **RVR** falls below a specified threshold, a locally generated alarm shall be sounded at the controller position.

'

**1-20.1.5.13** Log On/Log Off.- Each **SMD** operator shall log on identifying himself and supply a password which shall determine his level of access. The password shall not be displayed when entered. Level 0 access shall only be capable of requesting data pages to be displayed.  Level 1 access shall have the capability to input data (such as **ATIS** character) which are not sensor oriented, enable/disable displaying of sensor collected data, assign runways, and select display subsystem configurations.  Level 2 access identifiers, modify access levels and other adaptation data, and format data pages.  **RMM** level 2 access shall have the capability as specified in Part 3 of this **ER.**  This multi-level access shall provide appropriate security for the different categories of information in the system.

**1-20.1.5.14** Entry of Adaptation Data.- A user with level 1 access shall have the capability to add or delete user ID's , enter and modify passwords and levels of access as well as perform all level zero access functions.

A user with level 2 access shall also have the capability to display, modify and enter geographical and non-geographical adaptation data.  This will allow changes in airport and equipment configuration, personnel changes and system tuning parameters to be reflected in the **CPS** operational program without requiring programmer implementation or program modifications.  The geographic adaptation data includes external hardware, functional interface characteristics (e.g., number of intensity levels, I/O channel assigned and nomenclature), descriptions of runways (associated external hardware, **nomemclature)** , and assignment groupings of runways to controllers for configuration control.  Non-geographic adaption data includes **CPS** response utilization alert thresholds, **ALS** level 5 time parameter, flushing data disk to tape time limit, system state recording frequency, **failsoft** time delays, define display configurations, and the definition and assignment of data pages for the supplementary displays.

**1-20.1.5.15** Assign Runways **Function.-** The **SMD** operator shall have the capability to assign up to three runways to each individual controller position and remove runways from assignment to an individual controller position.  This will permit runway assignments to reflect the current airport operations.

**1-20.1.5.16** Configuration Control **Function.-** An **SMD** operator shall have the capability to select a **predefined** (by adaptation data) configuration (assignment of groups of runways to controllers).  This shall cause all previous assignments to be canceled and the **predefined** assignments to be made.

**1-20.1.5.13** Log On/Log Off.- Each **SMD** operator shall log on identifying himself and supply a password which shall determine his level of access. The password shall not be displayed when entered. Level 0 access shall only be capable of requesting data pages to be displayed.  Level 1 access shall have the capability to input data (such as **ATIS** character) which are not sensor oriented, enable/disable displaying of sensor collected data, assign runways, and select display subsystem configurations.  Level 2 access identifiers, modify access levels and other adaptation data, and format data pages.  **RMM** level 2 access shall have the capability as specified in Part 3 of this **ER.**  This multi-level access shall provide appropriate security for the different categories of information in the system.

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critical displays, backup CD data pages, and **TDs,** until the **SMD** operator **re-enables** the center field wind sensor data.  Either of these actions shall update the status of the center field wind in the sensor display inhibition page.  This will permit the **SMD** operator to enter wind data if the center field wind sensor is inoperative (see FAA Handbook **7210.3,** chapter **13,** section **2).**

**1-20.1.5.22** Control **VAS** Separation Distance Function.- An **SMD** operator shall be provided the capability to override the **VAS** separation distance by entering a desired separation by runway.  This shall cause the manually entered value to be displayed on the critical display of the individual controller to whom the runway is assigned until the **SMD** operator **re-enables** the **VAS** sensor collected data.  Either of these actions shall update the status of the **VAS** in the sensor display inhibition page.  This will permit the supervisor to enter separation distances in case of sensor outage.

**1-20.1.5.23** Control Runway Alert Data **Function.-An SMD** operator shall be provided the capability to specify the display of runway alert data or specify the override of the display of runway data.  This shall cause the specified alert to be displayed or inhibited from display on the critical displays and **TRACON** displays to which the runway is assigned, as **well** as the backup critical display page, until an **SMD** operator **re-enables** the alert data for the runway.  Any of these actions shall update the status of the runway monitoring sensors in the sensor display inhibition page.

**1-20.1.5.24** Input **ATIS** Character.- An **SMD** operator shall have the capability to enter the **ATIS** character for display at all positions on the critical and **TRACON** displays and on the backup critical display data pages.

**1-20.1.5.25** Display of Sensor Display Inhibition Page.- An **SMD** operator shall have the capability to display a data page listing those sensors which are displayable on the critical display.  This list shall indicate those sensors which have been **overriden** and inhibited and those which have not.  The sensor status (operable or non-operable) shall also be indicated. This shall provide the supervisor with a record of sensors which have been disabled and require manual updating of values for display, and an indication of which are candidates for **re-enabling.**

**1-20.1.5.26 Re-Enable** Critical Sensor Display Function.- An **SMD** operator shall have the capability to **re-enable** displaying of the sensor controlled data which has been disabled.  This shall cause the critical display to be updated from the sensor input and the sensor display inhibition page to be updated.

1-20.1.5.27 Control Lights **Function.-** For each runway assigned to him, the tower controller shall have the capability to select a light level for **ALS, MALS,** runway lights, centerline lights, and **VASI** or **REIL,** or he may turn them off (light level **0)** if controls are provided by the equipment.  The level selected shall be displayed to the local controller. If a level of 5 is selected (only available on **ALS),** an alarm shall be sounded after **14.5** minutes (adaptation parameter) to warn of the automatic hardware return to level 4 after **15** minutes.  This allows the controller to adapt the light levels to changing visibility conditions and respond to pilot requests for changes in light levels.

**1-20.1.5.28** Data Recording **Function.-** Data shall be recorded on disk and flushed to tape to be stored for later event reconstruction and to support appropriate FAA recording requirements.  All input data to the **CPS** shall be recorded on change with the time of receipt and a unique tag.  Output data, the time of the output, and the unique tag that correlates the output with the associated input, and the addresses to which the output is sent shall be recorded.  Some operator action shall be recorded whether or not the action is local (e.g., request supplementary page) or is sent to the **CPS** for processing.  System events (such as effecting a **failsoft** procedure) are logged on the recording medium.  Periodically (every **15** minutes [adaption parameter]) or when the data disk is flushed to tape, the system state shall be recorded.  The system state shall be a set of data which when reloaded in the **CPS,** shall cause the **CPS** and all displays to be reconstructed.

When the magnetic tape is almost full, an alert indicator (message) shall be displayed to the **CPS** operator.  If the tape is not replaced within **30** minutes (adaptation parameter), an alarm shall be sounded. When the tape unit is inactivated (e.g., for recording medium replacement) and the data disk is full, the recording shall be switched to the data area on the system disk.  If the data disk and the data area on the **system** disk are full, an alert indicator shall be displayed to the **CPS** operator and recording shall be suspended until a new tape or data disk is ready. If recording is suspended, the **CPS** shall continue to collect data and drive the displays.

If the system disk is used to record data, only data changes (not the system state) shall be recorded on the system disk and the system shall be recorded after the recording medium has been **redied** and all the recorded data on the data disk and system disk has been flushed to the new tape.

**1-20.1.5.29** Backup Critical Display Function.- One supplementary display data page shall be a backup to the critical display. It will allow a

controller to monitor the critical functions if his critical display is inoperative and will permit an **SMD** operator to monitor the information being displayed to the controllers.  Only areas in which the backup critical display page differs from the critical display will be described here.

All runways currently assigned shall be displayed.  The boundary winds (LLWSAS) shall be displayed constantly (since the individual controller display button does not affect the supplementary display).  For each boundary, the reading shall be highlighted if the **LLWSAS** alert is in effect for that boundary.

**1-20.1.5.30** Generate Simulation Data **Tape.-** The **CPS** operator shall have the capability to create a scenario specification by entering the start time of the scenario, which sensors are to be simulated, the frequency of sensor simulated messages, the message contents and the time at which the specified contents should first be sent.  The simulation program shall generate a file (optionally a disk or tape file) containing the specified messages in time order with time tags.  This file shall be identified in format to the messages in a recoding tape.  The purpose of the simulation function shall be to test the system performance.

**1-20.1.5.31** Simulation **Execution.-** The **CPS** operator shall have the capability to cause the system to be driven from a simulation file or recording tape.  All inputs shall be from the file and displays.  The file shall be read by the simulator driver which reads messages and delivers them to the input buffer under clock control.  The timing of the messages shall be determined by the time tags and delivery shall be made in real, fast, or slow (including freeze) time.  For event reconstruction from a recording tape, the reconstruction shall start at the first system state occurring after a specified time, and shall be event by event as well as real, fast, or slow time.

System event records shall optionally be displayed on the system console as they are delivered.

**1-20.1.5.32** Event **Reconstruction.-** The **CPS** operator shall be provided the capability to print the recording tape in a form that is easily read.  The event reconstruction shall be limited to a specified time interval.  The system state at the start and end of the time interval (as reconstructed) shall be printed, as well as any system states during the interval. If required, more than one tape shall be processed to reconstruct a time interval.

controller to monitor the critical functions if his critical display is inoperative and will permit an **SMD** operator to monitor the information being displayed to the controllers.   Only areas in which the backup critical display page differs from the critical display will be described here.

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TABLE 1-20-1

REMOTE INSTRUMENTS AND DEVICES

| Instruments | Data | Alarm Data | Status | Control |
|---|---|---|---|---|
| Coded Time Source | X | X | X | |
| DASI | X | X | X | |
| Center Field Wind | X | X | X | |
| RVR | X | X | X | |
| VAS | X | X | X | |
| LLWSAS | X | X | X | |
| Service A | X | X | X | |

| Instruments | Data | Alarm Data | Status | Control |
|---|---|---|---|---|
| ILS | X | X | X | X |
| ALS | X | X | X | X |
| SFL | X | X | X | X |
| VASI | | X | X | X |
| Runway Edge Light | X | X | X | X |
| Runway Center Line Light | X | X | X | X |
| REIL | X | X | X | X |
| FAA Radios* | | X | X | |
| VOR* | | X | X | |

*Not included in present system

TABLE 1-20-1

REMOTE INSTRUMENTS AND DEVICES

| Instruments | Data | Alarm Data | Status | Control |
|---|---|---|---|---|
| Coded Time Source | X | X | X | |
| DASI | X | X | X | |
| Center Field Wind | X | X | X | |
| RVR | X | X | X | |
| VAS | X | X | X | |
| LLWSAS | X | X | X | |
| Service A | X | X | X | |
| Instruments | Data | Alarm Data | Status | Control |
| ILS | X | X | X | X |
| ALS | X | X | X | X |
| SFL | X | X | X | X |
| VASI | | X | X | X |
| Runway Edge Light | X | X | X | X |
| Runway Center Line Light | X | X | X | X |
| REIL | X | X | X | X |
| FAA Radios* | | X | X | |
| VOR* | | X | X | |

*Not included in present system

        Supervisory/Maintenance Display **(SMD)**
        **TRACON** Display **(TD)**
        Lighting Control Panel **(LCP)**

The Critical Display shall be a custom built, high intensity, incandescent
filament display; the Supplementary Display shall be a small, high
intensity alphanumeric display; the **TD** shall be a small alphanumeric
display; and the **SMD** shall be a conventional alphanumeric CRT
display/terminal.

Status and operational data for these displays shall be provided by the
Remote Maintenance Monitoring System **(RMMS) FPUs.**

The functioning of the displays , and the gathering of data from, and the
control of, field sensors is described in the sections below, grouped in
Demonstable Units @U's) and ordered in a logical sequence for
implementation.  **DU's** 1 through **15** are site parameter system integration
**DU's** and shall be developed for site integration by the contractor. The
**DU's 11** through **15** shall be structured in accordance with **DU's** 1 through
**10.**

The **DU's** are functional in nature, if the contractor deviates from a
particular approach, an equivalent or better method shall be justified.

Table **1-20-2** lists the Demonstrable Units.

Table **1-20-3** relates the Functions described in Section **1-20.1.5** to the
Demonstrable Units described in Section **1-20.3.3** through **1-20.3.12.**

**1-20.3.2.1** Operational Capability

**1-20.3.2.1.1** Full Capability Description.- The controller (that is, the
local controller, ground controller, clearance delivery, and cab
coordinator), shall be supplied with a critical display containing display
information which is needed on a continuing basis or is needed instantly
(without the delay involved in requesting a display). Supplementary
information which is not needed instantaneously or continually shall be
provided on request on supplementary display areas.

The local controller shall have the capability to control the lights on the
runways assigned to him and to request an alarm when the Runway Visual
Range on runways assigned to him falls below a distance which he has
specified.

The user of an **SMD** shall have the capability to display all critical and supplementary information available to the controllers.  He shall have the capability to assign runways, enable, disable, and override sensors which provide information to the system and enter information to be displayed to the controllers as critical or supplementary data.

All data needed to reconstruct events and displays shall be recorded on machine readable, removable media (such as magnetic computer tapes) for event reconstruction and satisfaction of the applicable requirements of FAA Handbook **7210.3.**

The **SMD** user shall be subject to controlled access based on the users level of access.  The lowest level of access shall limit the user to displaying normal operational displays while subsequent levels shall permit entering, modifying, and deleting operational data and adaptation data.

**1-20.3.2.1.2** Reduced Capability Description.- If individual sensors reported on the critical display (**e.g.,** altimeter setting, center field wind) become non-operating, an **SMD** user shall have the capability to manually enter values for displays.  If the coded time source becomes non-operating, an **SMD** user shall have the capability to start the **CPS** real time clock at the correct time and cause the display to be updated from this clock.  If an individual controller's display or controls become non-operating,  an **SMD** user shall have the capability to reassign the runways to another position.  If only the critical display is affected, the supplementary display shall provide the capability to be used to display the critical display information in alternation with needed supplementary information.

The maintenance **SMD** shall be identical to the CAB and **TRACON SMDs** allowing both physical interchange of the units and software switching of functions to an operating display/terminal from a non-operating display/terminal.

Because of the absolute critical nature of the **ATC** tower functions, the **CPS** (see Part 3 of this **ER)** shall be configured for **100** percent failsafe processing in the event of a single component failure.  If one component of the **CPS** ceases to operate, the remaining components shall assume those functions permitting the **CPS** to meet the specified operator response time criteria and other performance requirement <u>with no data loss.</u>  If, however, multiple component failures occur, the **CPS** shall degrade in a **failsoft** manner by first **increasing** the response time, then inhibiting the lessor critical functions and finally falling back to the position that the local memory in the displays retains the last received data and **allow** the controller to view the critical display and select any supplementary page.

TABLE 1-20-2

LIST OF DEMONSTRABLE UNITS

| Section | DU | Description |
|---|---|---|
| 1-20.3.3 | 1 | Data base definition and data entry |
| 1-20.3.4 | 2 | Display definition |
| 1-20.3.5 | 3 | Supervisor console facilities |
| 1-20.3.6 | 4 | Data recording and simulation |
| 1-20.3.7 | 5 | Critical display functions |
| 1-20.3.8 | 6 | Input message processing |
| 1-20.3.9 | 7 | FPU polling |
| 1-20.3.10 | 8 | Service A (Aviation Weather Dissemination Network) |
| 1-20.3.11 | 9 | Control functions |
| 1-20.3.12 | 10 | Event reconstruction |
| * | 11 | System integration - coded time source, DASI, and center field wind |
| * | 12 | System integration - RVR, VAS, LLWSAS, and computer status |
| * | 13 | System integration - ILS and VOR |
| * | 14 | System integration - ALS, SFL, VASI, runway edge lights, runway center line lights, and REIL |
| * | 15 | System integration - FAA radio |

*Note:  To be provided by the contractor

TABLE 1-20-3

LIST OF FUNCTIONS BY DEFINITION SECTION
AND THE DU THAT PERFORMS THE FUNCTION

| Section | Function | DU |
|---|---|---|
| 1-20.1.5.1 | Define/modify data element | 1 |
| 1-20.1.5.2 | Edit/modify the contents of data element | 1 |
| 1-20.1.5.3 | Define/modify page | 2 |
| 1-20.1.5.4 | Supplementary display assignment | 3 |
| 1-20.1.5.5 | Display time function | 5 |
| 1-20.1.5.6 | Display barometric pressure | 5 |
| 1-20.1.5.7 | Display center field wind | 5 |
| 1-20.1.5.8 | Display assigned runway data | 5 |
| 1-20.1.5.9 | Display ATIS character | 5 |
| 1-20.1.5.10 | Surface observations (SA) | 8 |
| 1-20.1.5.11 | Surface wind display | 5 |
| 1-20.1.5.12 | Request runway visual range alarm | 5 |
| 1-20.1.5.13 | Log On/Log Off | 3 |
| 1-20.1.5.14 | Entry of adaptation data | 1 |
| 1-20.1.5.15 | Assign runways | 5 |
| 1-20.1.5.16 | Configuration control | 5 |
| 1-20.1.5.17 | Display supplementary displays | 2 |
| 1-20.1.5.18 | Acknowledgement | 3 |
| 1-20.1.5.19 | Control time | 1* |
| 1-20.1.5.20 | Control barometric pressure | 1* |
| 1-20.1.5.21 | Control center field wind | 1* |
| 1-20.1.5.22 | Control VAS separation distance | 1* |
| 1-20.1.5.23 | Control runway alarm data | 1* |
| 1-20.1.5.24 | Input ATIS character | 1* |
| 1-20.1.5.25 | Critical sensor display status | 2* |
| 1-20.1.5.26 | Re-Enable Critical Sensor display | 1* |
| 1-20.1.5.27 | Control lights | 9 |
| 1-20.1.5.28 | Data recording | 4 |
| 1-20.1.5.29 | Backup critical display | 5 |
| 1-20.1.5.30 | Generate simulation data tape | 4 |
| 1-20.1.5.31 | Simulation execution | 6 |
| 1-20.1.5.32 | Event reconstruction | 10 |
| 1-20.1.5.33 | Device control | 9 |
| 1-20.1.5.34 | On-line fault detection | 6 |
| 1-20.1.5.35 | Resource monitoring | 6 |

TABLE 1-20-3

LIST OF FUNCTIONS BY DEFINITION SECTION
AND THE DU THAT PERFORMS THE FUNCTION

| Section | Function | DU |
|---|---|---|
| 1-20.1.5.1 | Define/modify data element | 1 |
| 1-20.1.5.2 | Edit/modify the contents of data element | 1 |
| 1-20.1.5.3 | Define/modify page | 2 |
| 1-20.1.5.4 | Supplementary display assignment | 3 |
| 1-20.1.5.5 | Display time function | 5 |
| 1-20.1.5.6 | Display barometric pressure | 5 |
| 1-20.1.5.7 | Display center field wind | 5 |
| 1-20.1.5.8 | Display assigned runway data | 5 |
| 1-20.1.5.9 | Display ATIS character | 5 |
| 1-20.1.5.10 | Surface observations (SA) | 8 |
| 1-20.1.5.11 | Surface wind display | 5 |
| 1-20.1.5.12 | Request runway visual range alarm | 5 |
| 1-20.1.5.13 | Log On/Log Off | 3 |
| 1-20.1.5.14 | Entry of adaptation data | 1 |
| 1-20.1.5.15 | Assign runways | 5 |
| 1-20.1.5.16 | Configuration control | 5 |
| 1-20.1.5.17 | Display supplementary displays | 2 |
| 1-20.1.5.18 | Acknowledgement | 3 |
| 1-20.1.5.19 | Control time | 1* |
| 1-20.1.5.20 | Control barometric pressure | 1* |
| 1-20.1.5.21 | Control center field wind | 1* |
| 1-20.1.5.22 | Control VAS separation distance | 1* |
| 1-20.1.5.23 | Control runway alarm data | 1* |
| 1-20.1.5.24 | Input ATIS character | 1* |
| 1-20.1.5.25 | Critical sensor display status | 2* |
| 1-20.1.5.26 | Re-Enable Critical Sensor display | 1* |
| 1-20.1.5.27 | Control lights | 9 |
| 1-20.1.5.28 | Data recording | 4 |
| 1-20.1.5.29 | Backup critical display | 5 |
| 1-20.1.5.30 | Generate simulation data tape | 4 |
| 1-20.1.5.31 | Simulation execution | 6 |
| 1-20.1.5.32 | Event reconstruction | 10 |
| 1-20.1.5.33 | Device control | 9 |
| 1-20.1.5.34 | On-line fault detection | 6 |
| 1-20.1.5.35 | Resource monitoring | 6 |

1-20.3.3 Demonstrable Unit 1 — Data **Base.-** This **DU** describes the following functions:

    **Command** Input
    Data Base Definition
    Manual Data Entry

**1-20.3.3.1** System Components Required.- **CPS** and **SMD.**

**1-20.3.3.2** Other Demonstrable Units Required.- None.

**1-20.3.3.3** Function 1 — Command Input.- This function describes the following procedures:

    Display of **SMD** header message
    Input prompting
    Command string interpretation

**1-20.3.3.3.1** Procedure 1 — Display of **SMD** Header Message.- This procedure describes the general format of an **SMD** header message and specifies the initial default messages.

**1-20.3.3.3.1.1** External **Inputs.-** No external input shall be necessary for the initial 'displaying of headers.

**1-20.3.3.3.1.2** Functional **Processing.-** At system initialization time, the Cab **SMD,** the **TRACON SMD,** and the maintenance **SMD** shall be automatically sent a one line header described in the next section.

**1-20.3.3.3.1.3** External **Outputs.-** The **SMD** (console) header line shall have the following general format:

| Line 1 | prompt | title | page | | alert |
|--------|--------|-------|------|--|-------|

        Column 1              26         56         66   71          80

These fields are described as follows:

| Name | Columns | Description |
|------|---------|-------------|
| prompt | 1 — 25 | Prompting area for other functions |
| title | 26 — 55 | Display title (see below) |

| Name | Columns | Description |
|------|---------|-------------|
| page | 56 - 65 | Page mnemonic (where applicable) |
| reserved | 66 - 70 | Reserved |
| alert | 71 - 80 | Alert field |

The header line displayed at system initialization time shall use only the title field and contain:

    CAB CONSOLE
    TRACON CONSOLE, or
    MAINTENANCE CONSOLE

depending on the console to which the header is directed. All data displayed in the title shall be automatically centered.

A console display header shall be displayed at all times. When a data page is displayed, the page mnemonic shall appear in the page field (see Section 1-20.3.4). When Alerts occur, they shall be displayed in the Alert field (see Section 1-20.3.5), and when special prompts are required, they shall be displayed in the prompt field.

1-20.3.3.3.1.4 Error Processing.- In the event of a permanent write error to any of the console devices , the device shall be assumed to be unavailable and an error message shall be sent to the CPS operator's console device stating:

                             CAB
      PERMANENT WRITE ERROR ON TRACON                CONSOLE,
                             MAINTENANCE
      DEVICE ASSUMED UNAVAILABLE.

1-20.3.3.3.1.5 Quality Assurance Provisions.- On system initialization, the CAB, TRACON, and maintenance SMD headers shall be checked against the format specified in Section 1-20.3.3.3.1.3 above.

1-20.3.3.3.2 Procedure 2 - Input Prompting and Escape Modes.- This procedure describes the various prompts to be generated by the CPS and user command escape modes.

1-20.3.3.3.2.1 External Inputs.- The CPS shall generate a prompt at system initialization time and after the completion of a user input command, no explicit input shall be required.

| Name | Columns | Description |
|------|---------|-------------|
| page | 56 - 65 | Page mnemonic (where applicable) |
| reserved | 66 - 70 | Reserved |
| alert | 71 - 80 | Alert field |

The header line displayed at system initialization time shall use only the title field and contain:

       CAB CONSOLE
       TRACON CONSOLE, or
       MAINTENANCE CONSOLE

depending on the console to which the header is directed. All data displayed in the title shall be automatically centered.

A console display header shall be displayed at all times. When a data page is displayed, the page mnemonic shall appear in the page field (see Section 1-20.3.4). When Alerts occur, they shall be displayed in the Alert field (see Section 1-20.3.5), and when special prompts are required, they shall be displayed in the prompt field.

**1-20.3.3.3.1.4** Error Processing.- In the event of a permanent write error to any of the console devices , the device shall be assumed to be unavailable and an error message shall be sent to the CPS operator's console device stating:

                                 CAB
       PERMANENT WRITE ERROR ON  TRACON           CONSOLE,
                                 MAINTENANCE
       DEVICE ASSUMED UNAVAILABLE.

**1-20.3.3.3.1.5** Quality Assurance Provisions.- On system initialization, the CAB, TRACON, and maintenance SMD headers shall be checked against the format specified in Section 1-20.3.3.3.1.3 above.

**1-20.3.3.3.2** Procedure 2 - Input Prompting and Escape Modes.- This procedure describes the various prompts to be generated by the CPS and user command escape modes.

**1-20.3.3.3.2.1** External Inputs.- The CPS shall generate a prompt at system initialization time and after the completion of a user input command, no explicit input shall be required.

In each case, the cursor shall be placed immediately to the right of the generated prompt character thus:

> _____

>> _____

& _____

= _____

Unless otherwise specified, the prompt shall normally be placed in column 1 of line **2;** this entire line being reserved for the users command input. In cases where resultant output occupies less than a full page, subsequent prompts shall appear in column 1 of the next empty line.

**1-20.3.3.3.2.4** <u>Error Processing.</u>- There shall be no error processing.

**1-20.3.3.3.2.5** <u>Quality Assurance **Provisions**</u>.- Correct appearance of the prompt shall be verified at system initialization time and following command entry (see Section **1-20.3.3.3.3.5).**

**1-20.3.3.3.3** <u>Procedure 3 - Command String Interpretation</u>.- This procedure describes the general format for all **SMD** command input and specifies the general syntax checking and error processing performed.

**1-20.3.3.3.3.1** <u>External Inputs.</u>- In response to a command or subcommand **prompt,** the user shall enter his command or subcommand in the following form:

CMD, pp1, pp2, ● ..,ppn, kp1, kp2, . **\*s kpn

where:

**CMD** is the command mnemonic
**pp1, pp1,** .** , **ppn** are positional parameters
**kp1, kp2,** . . . . **kpn** are keyword parameters

**CMD,** the command mnemonic, shall be a unique alphanumeric name. The valid character set shall be A through Z and **Ø** through **9,** with upper and lower case letters, both acceptable but equated, e.g., **Abc** is considered to be the same as **aBc.**

**Subcommands** of a given command or subcommand shall be unique within a given branching of the command, **subcommand** tree. Subcommand names may be duplicated on the same level if they are in different **branchings** but may not be duplicates of any superior.   Figure **1-20-2** illustrates these rules.

A command may stand alone or it may have a variable number of positional and keyword parameters, the number of these parameters shall be limited only by the command definition.

Positional **parameters** are parameters whose meaning is determined by their position within the command input string.  Positional parameters shall follow the command mnemonic and precede all keyword parameters. The **command** and all parameters shall be separated by commas.  Embedded blanks shall be ignored unless contained in strings enclosed by apostrophes.

Positional parameters may be numeric or may be ASCII strings as required by the specific command.  Valid numeric formats shall be integer and real, and may include leading - or + signs.  Reals may be in scientific or **'E'** format with an **'E'** preceding the integer exponent field, e.g., $1, 1., 1.\emptyset, 1E\emptyset,$ $1.\emptyset E\emptyset, 1.\emptyset E+\emptyset$ shall be valid representations of the real number $1.$ All numerics shall be assumed to be base $1\emptyset.$

ASCII strings may be composed of the letters A through **Z, numers $\emptyset$** through 9 and the ASCII underline character **'_'**.  The underline may be used to represent an embedded blank, e.g., **'Time** of Day' may be represented by TIME OF_DAY.

Additional ASCII characters (including commas and blanks) may be used if the string is enclosed within apostrophes.  Apostrophes within a string shall be represented by two consecutive apostrophes, e.g., **'O''NEILL' =** O'NEILL.

A single positional parameter may represent a list of strings or numbers; such a list must be enclosed in parentheses, e.g., **"CMD,** (ABC, **DEF), (123,** 4567), where (ABC, **DEF)** is a list of input strings satisfying the first positional parameter of **CMD** and **(123, 4567)** is a list of numbers satisfying the second positional parameter.  The **permissability** of this optional form shall be specified in the applicable command definitions.  This form may also be used for values of keyword parameters.

**Subcommands** of a given command or subcommand shall be unique within a given branching of the command, **subcommand** tree. Subcommand names may be duplicated on the same level if they are in different **branchings** but may not be duplicates of any superior.  Figure **1-20-2** illustrates these rules.

A command may stand alone or it may have a variable number of positional and keyword parameters, the number of these parameters shall be limited only by the command definition.

Positional **parameters** are parameters whose meaning is determined by their position within the command input string.  Positional parameters shall follow the command mnemonic and precede all keyword parameters. The **command** and all parameters shall be separated by commas.  Embedded blanks shall be ignored unless contained in strings enclosed by apostrophes.

Positional parameters may be numeric or may be ASCII strings as required by the specific command.  Valid numeric formats shall be integer and real, and may include leading - or + signs.  Reals may be in scientific or **'E'** format with an **'E'** preceding the integer exponent field, e.g., $1, 1., 1.\emptyset, 1E\emptyset$, $1.\emptyset E\emptyset, 1.\emptyset E+\emptyset$ shall be valid representations of the real number 1. All numerics shall be assumed to be base $1\emptyset$.

ASCII strings may be composed of the letters A through **Z, numers $\emptyset$** through 9 and the ASCII underline character **'_'**.  The underline may be used to represent an embedded blank, e.g., **'Time** of Day' may be represented by TIME OF_DAY.

Additional ASCII characters (including commas and blanks) may be used if the string is enclosed within apostrophes.  Apostrophes within a string shall be represented by two consecutive apostrophes, e.g., **'O''NEILL' =** O'NEILL.

A single positional parameter may represent a list of strings or numbers; such a list must be enclosed in parentheses, e.g., **"CMD,** (ABC, **DEF), (123,** 4567), where (ABC, **DEF)** is a list of input strings satisfying the first positional parameter of **CMD** and **(123, 4567)** is a list of numbers satisfying the second positional parameter.  The **permissability** of this optional form shall be specified in the applicable command definitions.  This form may also be used for values of keyword parameters.

Keyword parameters may stand alone and represent a defined value or
meaning, or they may be assigned a value by the user, **e.g., CMD,** keyword =
value, where 'keyword' is an ASCII string specified in the applicable
command definition.  Keywords may be of any length, but must h&e their
leading two characters unique within a given command. These two unique
characters may be used to abbreviate the keyword, **e.g.,** KEYWORD = and **KE** =
are equivalent.

Value may be a numeric or an ASCII string, as defined above, or may be a
**subkey** belonging to a set of **subkeys** specified in the individual command
definition.

The command line interpreter **(CLI)** shall also accept macro input, both for
full commands and for portions of a command.  A macro shall be defined by
the command **> S$,** name, where 'name' is a special **mnemonic** name of up to
eight **(8)** characters **begining** with a dollar sign **($).** The S$ command shall
result in an input prompt.  For example,> **S$, $MACRO1 =** user's input,
which may consist of one or more lines, terminated by a null **line.**

The above shall define **$MACRO1** as a **psuedo** input. The commands **D$** and **X$**
shall **alllow** the user to display a macro and to delete a macro
respectively.  The following examples illustrate the use of the macro:

> **S$, $SF1**
= SF, Family 1
=
> **$SF1**

The above is simply equivalent to "SF, FAMILY **1´,** the use of a macro name
in the command field causes the macro to be referenced and executed as
though it were a complete command line.

  **S$, $KW1**
= **S**IZE = 1, EXPIRES = **Ø1ØØ**
=
> **SF,** FAMILY 2, $KW1
> ____

The above is equivalent to "SF, **FAMILY2,** SIZE = 1, EXPIRES = **Ø1ØØ´.** The
macro replaces its symbolic value and is interpreted as part of the user's
command.  All standard syntax rules and error checks are applied.

```
> D$, $KW1
SIZE = 1, EXPIRES = 0100
> X$, $KW1
> ____
```

The above displays $KW1's contents and then deletes it.

1-20.3.3.3.3.2 Functional Processing.- All commands and subcommands shall
be processed by a command line interpreter which shall be driven by a list
of valid commands, subcommands, parameters, and associated data types.
This **CLI** shall perform the error checking indicated in Section
1-20.3.3.3.3.4below. Each input line shall be 'checked for completeness.
If any line ends in a comma or has unbalanced parentheses, it shall be
considered incomplete. In this case, the user shall be prompted with the
continuation prompt. No command processing shall take place until the
command has been completed. The **CLI** shall pass the input line and
continuations and produce an output list of validated parameters for
processing by a command specific module.

1-20.3.3.3.3.3 External Outputs.- This **CLI** shall prompt for continuation
lines.

1-20.3.3.3.3.4 Error Processing.- This **CLI** shall detect and respond to two
types of errors: syntax errors and data type errors. Command and
subcommand names shall be checked against a list of valid names and the
following message shall be generated in case of error:

```
name IS NOT A VALID   COMMAND    |
                      [ SUBCOMMAND |
```

This error shall terminate processing of the command and result in a prompt
for a new command or subcommand at the same level.

Positional parameters shall be checked for number and data type. Too few
or too many parameters shall result in the message:

```
TOO MANY| POSITIONAL PARAMETERS,
    [FEW |

THIS COMMAND   | REQUIRES n.
    [SUBCOMMAND |
```

The type of each positional parameter shall be checked against that specified in the command list and the following error message shall be generated if a type error occurs:

POSITIONAL PARAMETER **n,** 'input string'

MUST BE | ASCII |
        | NUMERIC |

Specific data value checking shall not be done by this function. The input string shall be passed to the module processing the specific command and all further error checking shall occur at that time.

Keyword parameters shall be checked against a list of valid keywords for the **command,** and if no match is found, the following error shall be printed.

KEYWORD name IS NOT A VALID PARAMETER OF

command name.

Conflicting keywords shall result in the message:

name AND name (AND name...) ARE CONFLICTING KEYWORDS.

The type of all values assigned to keywords shall also be checked; a bad numeric or ASCII value shall cause the following:

'input string' MUST BE | ASCII |
              | NUMERIC |

An illegal keyword value shall result in:

keyword value IS NOT A VALID VALUE FOR keyword.

Conflicting keyword values shall result in the message:

value AND value (AND value...) ARE CONFLICTING VALUES FOR keyword.

1-20.3.3.3.3.5 Quality Assurance Provisions.- All error conditions shall be exercised.

The type of each positional parameter shall be checked against that specified in the command list and the following error message shall be generated if a type error occurs:

    POSITIONAL PARAMETER **n,** 'input string'

    MUST BE | ASCII |
            | NUMERIC |

Specific data value checking shall not be done by this function. The input string shall be passed to the module processing the specific command and all further error checking shall occur at that time.

Keyword parameters shall be checked against a list of valid keywords for the **command,** and if no match is found, the following error shall be printed.

    KEYWORD name IS NOT A VALID PARAMETER OF

    command name.

Conflicting keywords shall result in the message:

    name AND name (AND name...) ARE CONFLICTING KEYWORDS.

The type of all values assigned to keywords shall also be checked; a bad numeric or ASCII value shall cause the following:

    'input string' MUST BE | ASCII |
                           | NUMERIC |

An illegal keyword value shall result in:

    keyword value IS NOT A VALID VALUE FOR keyword.

Conflicting keyword values shall result in the message:

    value AND value (AND value...) ARE CONFLICTING VALUES FOR
    keyword.

1-20.3.3.3.3.5 <u>Quality Assurance Provisions.</u>- All error conditions shall be exercised.

Conflicting definitions shall be resolved using the following set of rules:

(a) Member definitions override Family definitions

(b) Input Message definitions override Member and Family definitions.

(c) For display purposes, Display Page definitions override all other SIZE definitions, display fields being truncated or padded with blanks as necessary.

1-20.3.3.4.1.1 External Inputs.- The syntax of the Specify Family command shall be:

> **SF,** Family name, [vector **1,** vector **2,** . . . . . vector **n],**
> [TYPE **=** Family type], [SIZE **=** number of characters],
> [INSTANCE = number of instances], [REPLACE = criterion],
> [CALL = checker], [ALARM = devices], [ALERT = devices],
> [EXPIRES = time], [PROTECT = (delete, modify, display)]

where 'Family name' shall be any valid ASCII name composed of 1 to 8 characters. By convention, Family names shall be made up of alphanumeric characters only. The optional parameters 'vector **1,** vector **2,...,** vector **n'** shall represent orthogonal (mutually exclusive) sets of qualifier names defining the axes of a structured Family 'space'. These parameters shall be specified only for structured Families.

The keyword TYPE may have the values L or **S.** L shall indicate that the Family consists of List Data Elements, S shall indicate that the Family is structured. **The** default shall be **S.**

SIZE shall be set equal to the display length of the Data Element in characters (defaulting to **∅).** The alternate form SIZE = V shall specify that the Data Element is of variable length.

INSTANCE shall be the Data Element stack depth parameter. A Data Element shall have successive instances or occurrences stored for trending or queuing purposes. The Value of INSTANCE shall be a positive integer (defaulting to **1).** New input to the Data Element shall result in creation of a new instance in a First In - First Out (FIFO) manner. When the stack is full, new additions shall delete the oldest instance.

REPLACE shall indicate the Data Element replacement criterion. Legal values for this keyword shall be: INPUT, CHANGE, NEVER (defaulting to CHANGE). INPUT shall indicate that the Data Element content and time tag

are to be updated whenever a new input message for that Data Element is
received. CHANGE shall indicate that the Data Element is to be updated
only when its content changes. NEVER shall specify that the Data Element
shall not be changed by input messages. This keyword REPLACE shall only
apply to Data Elements which are the object of input messages from external
sources.

CALL shall specify the name of a special purpose software module which
shall be invoked whenever a Data Element is REPLACEd.

ALARM and ALERT specify that a Data Element shall generate user Alarms and
Alerts. These parameters are defined in Section 1-20.3.8.3.

EXPIRES shall indicate that the current values of a Data Element are to be
deleted after a.fixed period of time. This parameter has the form:

        EXPIRES = (hhmm, [replacement value])

where:

hhmm shall be the time interval in hours and minutes (limit 2400) after
which the data is to be deleted. The optional replacement value shall be
an ASCII string, no longer than the SIZE of the Data Element which shall be
substituted on EXPIRATION (this shall default to ASCII blanks).

PROTECT shall specify the access level required to access a Data Element
for a given action. Three categories of protection are defined: delete,
modify, and display. The value of these subparameters shall vary from $\emptyset$
to 2 and represent the user's access level necessary for deletion,
modification, or display of the Family and members in question. The
implementation of these features is discussed in Section 1-20.3.5.3.2.

A typical SF command might be:

        SF, TIME, (CTS, INTERNAL)

This shall specify that the family TIME may be composed of the Data
Elements TIME:CTS and TIME:INTERNAL. It should be noted that this command
does not define the individual data elements, but rather describes the
space in which they exist.

are to be updated whenever a new input message for that Data Element is received.   CHANGE shall indicate that the Data Element is to be updated only when its content changes.   NEVER shall specify that the Data Element shall not be changed by input messages.   This keyword REPLACE shall only apply to Data Elements which are the object of input messages from external sources.

CALL shall specify the name of a special purpose software module which shall be invoked whenever a Data Element is REPLACEd.

ALARM and ALERT specify that a Data Element shall generate user Alarms and Alerts.   These parameters are defined in Section 1-20.3.8.3.

EXPIRES shall indicate that the current values of a Data Element are to be deleted after a fixed period of time.   This parameter has the form:

        EXPIRES = (hhmm, [replacement value])

where:

hhmm shall be the time interval in hours and minutes (limit 2400) after which the data is to be deleted.   The optional replacement value shall be an ASCII string, no longer than the SIZE of the Data Element which shall be substituted on EXPIRATION (this shall default to ASCII blanks).

PROTECT shall specify the access level required to access a Data Element for a given action.   Three categories of protection are defined: delete, modify, and display.   The value of these subparameters shall vary from $\emptyset$ to 2 and represent the user's access level necessary for deletion, modification, or display of the Family and members in question.   The implementation of these features is discussed in Section 1-20.3.5.3.2.

A typical SF command might be:

        SF, TIME, (CTS, INTERNAL)

This shall specify that the family TIME may be composed of the Data Elements TIME:CTS and TIME:INTERNAL.   It should be noted that this command does not define the individual data elements, but rather describes the space in which they exist.

In the above definition, square brackets indicate optional parameters, the definitions of positional and **keyword parameters** are the same as in the Command input description (Section **1-20.3.3.3.3**).

The positional parameter indicated by 'list name' shall be a single name or a list of names enclosed in parentheses. Each **name** shall be a valid List Data Element name. A List Data Element shall be a Member of Family and shall be in the form **FAMILY:MEMBER**.

The Member name shall be composed of one or more qualifiers. Certain commands assume a hierarchical ordering of lists. For instance the lists

> **SYS:COMMANDS** and
> **SYS:COMMANDS.SF** and
> **SYS:COMMANDS.SL**

are part of the hierarchy of command definition lists **COMMANDS.SF** and **COMMANDS.SL** shall be referred to as 'sublists' of COMMANDS.

PROTECT shall designate the levels of access protection necessary to delete, modify, or display the list. These values shall override the values specified in the SF command (see Section **1-20.3.3.4.1**).

If no other parameters are specified, the list shall be assumed to be totally free in format. If either **PP** or **KP** are specified, the list shall be considered to be in command input **format** and full command input syntax checking shall be applied to subsequent list input or modification.

The **PP** and **KP** keywords shall specify the syntax as **follows: PP** shall specify the type, limits, and defaults of the positional parameters. **KP** shall specify the names, types, limits, and defaults of the keyword parameters.

Parameter types shall be described by a three letter **composite** from the table below:

0	A	U
M	I	V
	R	L
	0	C
	H	

The first letter shall be 0 for Optional or M for Mandatory and shall designate whether the parameter or subparameter is required in input.

The second letter shall specify the data type to be ASCII, INTEGER, REAL, OCTAL, or HEXADECIMAL. Input data shall be checked for character set validity based on this type.

The third letter shall specify further validation as follows:

U specifies unformatted, requires no validation.
V specifies that a list of valid values follows.
L specifies that numeric limits are to apply.
C specifies that a character count limit is to be applied.

U and V shall apply to all types; C shall apply only to ASCII; L shall apply to all types except ASCII.

For U, the type specification syntax shall be: aaU

For V: (aaV, default value, value 1, value 2, ... value n)

For L: (aaL, default value, lower limit, upper limit)

For C: (aaC, default value, minimum count, maximum count)

PP shall be specified as follows:

PP = (type specification 1, [type specification 2, • ... type specification n], [*])

where '*' indicates that the last type specification may be repeated indefinitely to allow a variable number of positional parameters. This may be specified only if the last type specification is OPTIONAL. An example might be:

PP = (MAU, [MIL, 2 Ø, 2), (MAV, YES, YES, NO), OAU, *]

In the above example, three mandatory and an unlimited number of optional positional parameters are specified. The first is free format ASCII, the second INTEGER ranging from Ø to 1 with a default value of 2, the third ASCII having the values YES or NO defaulting to YES, and the optionals being free format ASCII.

KP shall be specified as follows:

KP = (keyword 1 = type specification, keyword 2 = type specification, ... keyword n = type specificatiion)

The second letter shall specify the data type to be ASCII, INTEGER, REAL, OCTAL, or HEXADECIMAL. Input data shall be checked for character set validity based on this type.

The third letter shall specify further validation as follows:

> U specifies unformatted, requires no validation.
> V specifies that a list of valid values follows.
> L specifies that numeric limits are to apply.
> C specifies that a character count limit is to be applied.

U and V shall apply to all types; C shall apply only to ASCII; L shall apply to all types except ASCII.

For U, the type specification syntax shall be: aaU

For V: (aaV, default value, value 1, value 2, ... value n)

For L: (aaL, default value, lower limit, upper limit)

For C: (aaC, default value, minimum count, maximum count)

PP shall be specified as follows:

> PP = (type specification 1, [type specification 2, • ... type specification n], [*])

where '*' indicates that the last type specification may be repeated indefinitely to allow a variable number of positional parameters. This may be specified only if the last type specification is OPTIONAL. An example might be:

> PP = (MAU, [MIL, 2 Ø, 2), (MAV, YES, YES, NO), OAU, *]

In the above example, three mandatory and an unlimited number of optional positional parameters are specified. The first is free format ASCII, the second INTEGER ranging from Ø to 1 with a default value of 2, the third ASCII having the values YES or NO defaulting to YES, and the optionals being free format ASCII.

KP shall be specified as follows:

> KP = (keyword 1 = type specification, keyword 2 = type specification, ... keyword n = type specificatiion)

1-20.3.3.4.3.2 External Inputs.- The syntax of the Modify List command
shall be:

ML, list name, [(search string), (replacement string), (ALL), (NV)] where
'list name' shall be a valid, fully qualified, List Data Element name.
Valid subcommands shall be:

>> CL, search string, [replacement string], [ALL], [NV]
>> XL
>> NL
>> PL
>> TOP
>> SAV

where CL shall stand for Change Line, XL for Delete Line, **NL** for Next Line,
and **PL** for previous line.

The 'search string' optional parameter shall allow the user to request that
the list be searched for an occurrence of a given ASCII string.

The 'replacement string' optional parameter shall allow the user to specify
a string to replace the 'search string'.

The keyword ALL shall signify that the string replacement process is to be
applied to all occurrences of the 'search string'. The NV keyword shall
indicate that this multiple replacement process shall proceed without user
verification.

1-20.3.3.4.3.2 Functional Processing;.- If the user enters the ML command
with no optional parameters, the first line of the List shall be displayed.
The user may modify this (or any other displayed line) by using the cursor
positioning capability to place the cursor on the characters to be changed
and entering his modification and a carriage return (CR). If he does not
move the cursor, he shall be in subcommand input mode.

If the user specifies a search string with the ML command, the first line
containing that string shall be displayed. If he specifies a 'replacement
string' that string shall replace the specified search string. If the ALL
keyword is specified, all occurrences of 'search string' shall be

successively located, and, if NV is specified, shall be replaced by
'replacement string'.

If the user does not specify NV, the processing shall halt before each
replacement and the user shall be shown the line containing the search
string and prompted to:

> ENTER **'R'** TO REPLACE OR HIT RETURN TO SKIP.
> 〉〉〉_____

If the user replies with **'R',** the replacement shall be carried out; if he
hits carriage return (CR), the replacement shall be skipped. This shall
continue until the last line is processed; the user shall then be prompted
with the subcommand prompt (〉〉 _____).

The CL subcommand shall perform the same processing as ML except that all
CL actions shall begin with the currently displayed line and proceed
downward through the list.

The **XL** subcommand shall delete the currently displayed line from the list.

The **NL** and **PL** subcommands shall be used to move upward or downward one line
and the TOP subcommand shall move back to the first line of the list.

1-20.3.3.4.3.3 External **Outputs.-** When the ML command is processed, a
scratch version of the List Data Element specified shall be created. All
modifications additions or deletions resulting from ML subcommands shall be
made on the scratch list. When a **SAV** subcommand is entered, the scratch
List shall be copied into the permanent List. If an attempt is made to
leave the ML command mode (via **ESC),** the message:

> **WARNING:NOTHING** SAVED, ENTER **SAV** OR HIT **ESC** KEY TO TERMINATE.

shall be displayed. A response of **SAV** shall save the scratch List and
terminate processing. A second **ESC** shall cause termination without saving.

1-20.3.3.4.3.4 Error Processing.- The following error checks shall be
made: The 'list name' shall be checked against the lists of lists. If no
match is found, the message: LIST MODIFICATION **ERROR:list** name IS NOT A
LIST shall be displayed and processing terminated. If the user's access
level does not entitle him modification access to the list, the message:
LIST MODIFICATION **ERROR:ACCESS** NOT VALID FOR LIST shall be displayed and
processing terminated.

successively located, and, if NV is specified, shall be replaced by
'replacement string'.

If the user does not specify NV, the processing shall halt before each
replacement and the user shall be shown the line containing the search
string and prompted to:

> ENTER **'R'** TO REPLACE OR HIT RETURN TO SKIP.
> ⟩⟩⟩ _____

If the user replies with **'R',** the replacement shall be carried out; if he
hits carriage return (CR), the replacement shall be skipped. This shall
continue until the last line is processed; the user shall then be prompted
with the subcommand prompt (⟩⟩ _____).

The CL subcommand shall perform the same processing as ML except that all
CL actions shall begin with the currently displayed line and proceed
downward through the list.

The **XL** subcommand shall delete the currently displayed line from the list.

The **NL** and **PL** subcommands shall be used to move upward or downward one line
and the TOP subcommand shall move back to the first line of the list.

1-20.3.3.4.3.3 External **Outputs.-** When the ML command is processed, a
scratch version of the List Data Element specified shall be created. All
modifications additions or deletions resulting from ML subcommands shall be
made on the scratch list. When a **SAV** subcommand is entered, the scratch
List shall be copied into the permanent List. If an attempt is made to
leave the ML command mode (via **ESC),** the message:

> **WARNING:NOTHING** SAVED, ENTER **SAV** OR HIT **ESC** KEY TO TERMINATE.

shall be displayed. A response of **SAV** shall save the scratch List and
terminate processing. A second **ESC** shall cause termination without saving.

1-20.3.3.4.3.4 Error Processing.- The following error checks shall be
made: The 'list name' shall be checked against the lists of lists. If no
match is found, the message: LIST MODIFICATION **ERROR:list** name IS NOT A
LIST shall be displayed and processing terminated. If the user's access
level does not entitle him modification access to the list, the message:
LIST MODIFICATION **ERROR:ACCESS** NOT VALID FOR LIST shall be displayed and
processing terminated.

if 'search string' is not found, the message:

     SEARCH STRING NOT FOUND

shall be displayed and processing terminated.

If the ALL keyword is specified, all lines containing the search string shall be displayed. If more than one display is required, **PU** and **PD** subcommands shall be used as above.

1-20.3.3.4.4.3 External **Ouputs.-** As described under Functional Processing above.

1-20.3.3.4.4.4 Error Processing.- The following error checks shall be made: The 'list name' shall be checked against the list of lists. If no matching entry is found, the **message:LIST** DISPLAY **ERROR:list** name IS NOT A LIST shall be displayed and processing terminated. If the user's access level does not entitle him display access to the list, the **message:LIST** DISPLAY **ERROR:ACCESS** NOT VALID FOR LIST shall be displayed and processing terminated.

The following warning messages shall be defined:

     LIST DISPLAY **WARNING:TOP** OF LIST

which shall be displayed if a **PU** command is entered when the top line of the list is displayed, and:

     LAST DISPLAY **WARNING:BOTTOM** OF LIST

which shall be displayed if a **PD** command is entered when the bottom line of the list is displayed.

1-20.3.3.4.4.5 Quality Assurance Provisions.- This procedure shall be verified by entering valid and invalid list names and existent and non-existent search string. The functioning of the **PU** and **PD** subcommands and the ALL keyword shall be verified.

1-20.3.3.4.5 Procedure 5 - Specify Structured Family Members.- For each structured Family, there shall be a list of defined members of that family. A member name concatenated to a Family name in the form **Family:Member** shall be referred to as a Data Element name. A member name shall be composed of one or more of the qualifier names in the form:

qualifier.qualifier.qualifier.

For the family defined by:

SF, RADIO, **(CH1, CH2),** (PRIME, BACKUP), **(FREQ,** STATUS)

RADIO:CH2.BACKUP.STATUS shall define a Data Element whose value is the status of the backup channel 2 radio. Since the qualifier vectors are orthogonal (e.g., must contain qualifier names which are unique within the family), the form:

RADIO:BACKUP, CH2.STATUS

shall be the same data element as that specified above.

1-20.3.3.4.5.1 External Inputs.- The user shall enter data into, or modify the Family Member description List via the Modify List (ML) command described in Section **1-20.3.3.4.3.** The name of the list shall be:

SYS:FAMILY NAME:MEMBERS

where 'family name' is the name of the Family whose Members are being described.

The attributes of a Member shall be the same as that of its Family unless otherwise specified. Each line of the Member Description List shall be composed of Member names and optional attributes overrides.

In each case, the member name specified shall be a single member name or an implied list. An 'implied list' shall be a member name in which one or more of the qualifiers is replaced by an ASCII asterisk. This asterisk is called a 'wild card' and indicates that the replaced qualifier may take on any of the defined values specified in the family specification. For example, given the family specification:

SF, RADIO, **(CH1, CH2),** (PRIME, BACKUP), **(FREQ,** STATUS)

the member name

CH2.*.STATUS

would be an implied list consisting of:

qualifier.qualifier.qualifier.

For the family defined by:

      SF, RADIO, **(CH1, CH2),** (PRIME, BACKUP), **(FREQ,** STATUS)

RADIO:CH2.BACKUP.STATUS shall define a Data Element whose value is the status of the backup channel 2 radio. Since the qualifier vectors are orthogonal (e.g., must contain qualifier names which are unique within the family), the form:

      RADIO:BACKUP, CH2.STATUS

shall be the same data element as that specified above.

1-20.3.3.4.5.1 External Inputs.- The user shall enter data into, or modify the Family Member description List via the Modify List (ML) command described in Section **1-20.3.3.4.3.** The name of the list shall be:

      SYS:FAMILY NAME:MEMBERS

where 'family name' is the name of the Family whose Members are being described.

The attributes of a Member shall be the same as that of its Family unless otherwise specified. Each line of the Member Description List shall be composed of Member names and optional attributes overrides.

In each case, the member name specified shall be a single member name or an implied list. An 'implied list' shall be a member name in which one or more of the qualifiers is replaced by an ASCII asterisk. This asterisk is called a 'wild card' and indicates that the replaced qualifier may take on any of the defined values specified in the family specification. For example, given the family specification:

      SF, RADIO, **(CH1, CH2),** (PRIME, BACKUP), **(FREQ,** STATUS)

the member name

      CH2.*.STATUS

would be an implied list consisting of:

shall be generated if the family or members are not defined. These errors
shall result in termination of command processing.

If a modification input would delete a Member also specified in an Input
Message or on a Display Page, the message:

SPECIFY MEMBER ERROR:name IS SPECIFIED IN

AN INPUT MESSAGE AND MUST NOT BE DELETED
A DISPLAY PAGE

shall be displayed and the modification aborted.

1-20.3.3.4.3.5 Quality Assurance Provisions.- This procedure shall be
tested by entering command input in valid and invalid form. The above
error shall be exercised. Results of valid and invalid input shall be
observed by redisplaying the Member Definition List after each attempted
deletion or modification.

1-20.3.3.5 Function 3 - Manual Data Entry.- This function shall allow the
user to enter or modify the contents of a data element or data elements to
which his access level entitles access, and similarly to display the
content of a data element. These two procedures are described below.

1-20.3.3.5.1 Procedure 1 - Enter Data Element Value.- This procedure
allows the user to access any defined data element for data entry or
modification.

1-20.3.3.5.1.1 External **Inputs.-** The syntax of the edit Data Element
command shall be:

> ED, Data Element name, (ATTRIBUTES)

where 'Data Element name' is the fully qualified Data Element name as
specified in Section **1-20.3.3.4.5** above. This name may contain wild cards,
in which case, processing and output actions described below are repeated
for each data element implied or until terminated by a user input escape
command.

1-20.3.3.5.1.2 Functional **Processing.-** When a data element name or implied
list is received, it shall be checked for validity against the family list
and against the list of defined members for the family specified. If a
non-empty Data Element name, (attributes) = current value

The process shall check input data for size and type validity. The edited user input shall replace the current data element contents. A null line shall indicate that the user does not wish to alter the current value. In the case of an implied list , this process shall be repeated until the list is exhausted or until the user terminates processing.

For Data Elements whose content is previously undefined, the process shall be the same except that the prompt shall be:

    Data Element name, (attributes), CURRENTLY UNDEFINED = _.

The process shall define a data base entry for the data element and insert the user's input. A null response from the user shall result in no data base entry being defined.

1-20.3.3.5.1.3 External **Outputs.-** User prompts described above.

1-20.3.3.5.1.4 Error Processing.- The following error checking shall be performed: the data element shall be checked against the list of defined elements, if no match is found, the error message:

    DATA ENTRY **ERROR:name** IS NOT A DEFINED DATA **ELEMENT**

shall be generated and command processing terminated. If an implied list was specified, it shall be tested to see if any defined elements exist, if none do, the message: DATA ENTRY ERROR: list CONTAINS NO DEFINED DATA ELEMENTS shall be generated and command processing terminated.

In modification for each data element specified, the user's access level shall be checked against the required level for the element; if the two levels do not agree, the message:

    DATA ENTRY ERROR: user id NOT AUTHORIZED TO MODIFY name

shall be generated and processing for that data element shall be terminated.

1-20.3.3.5.1.5 Quality Assurance Provisions.- This procedure shall be tested by entering command input in valid and invalid form. All error traps described above shall be exercised. Results of valid and invalid input shall be observed by redisplaying the data element after each attempted modification.

1-20.3.3.5.2 Procedure 2 — Display Data Element Content.- This procedure allows the user to display the content of any defined data element or implied list of data elements.

1-20.3.3.5.2.1 External Inputs.- The syntax of the display data element command shall be >DE, data element name, [ATTRIBUTES] where the user input parameters are as described for the ED command described in Section 1-20.3.3.5.1.1 above.

1-20.3.3.5.2.2 Functional Processing.- As in Section 1-20.3.3.5.1.2, except that no input prompt shall be displayed and no modification input accepted.

1-20.3.3.5.2.3 External Outputs.- As described in Section 1-20.3.3.5.1.2 above.

1-20.3.3.5.2.4 Error Processing.- As described in Section 1-20.3.3.5.1.4 except that no input validity checking is necessary.

1-20.3.3.5.2.5 Quality Assurance Provisions.- This procedure shall be tested by redisplaying data entered via the ED command and comparing the ED and DE displays.

1-20.3.4 Demonstrable Unit 2 — Display Definition.- This DU describes the following functions:

        Page description
        Page displays

1-20.3.4.1 System Components Required.- CPS and SMD.

1-20.3.4.2 Other Demonstrable Units Required.- DU1.

1-20.3.4.3 Function 1 — Page Description.- This function describes the following procedures:

        Page Characteristics Specification
        Content Description
        Format Description

1-20.3.4.3.1 Procedure 1 — Page Characteristics Specification.- This procedure shall allow the user to specify a display page and to describe certain properties of the displayed page.

1-20.3.3.5.2 Procedure 2 — Display Data Element Content.- This procedure allows the user to display the content of any defined data element or implied list of data elements.

1-20.3.3.5.2.1 External Inputs.- The syntax of the display data element command shall be >DE, data element name, [ATTRIBUTES] where the user input parameters are as described for the ED command described in Section 1-20.3.3.5.1.1 above.

1-20.3.3.5.2.2 Functional Processing.- As in Section 1-20.3.3.5.1.2, except that no input prompt shall be displayed and no modification input accepted.

1-20.3.3.5.2.3 External Outputs.- As described in Section 1-20.3.3.5.1.2 above.

1-20.3.3.5.2.4 Error Processing.- As described in Section 1-20.3.3.5.1.4 except that no input validity checking is necessary.

1-20.3.3.5.2.5 Quality Assurance Provisions.- This procedure shall be tested by redisplaying data entered via the ED command and comparing the ED and DE displays.

1-20.3.4 Demonstrable Unit 2 — Display Definition.- This DU describes the following functions:

> Page description
> Page displays

1-20.3.4.1 System Components Required.- CPS and SMD.

1-20.3.4.2 Other Demonstrable Units Required.- DU1.

1-20.3.4.3 Function 1 — Page Description.- This function describes the following procedures:

> Page Characteristics Specification
> Content Description
> Format Description

1-20.3.4.3.1 Procedure 1 — Page Characteristics Specification.- This procedure shall allow the user to specify a display page and to describe certain properties of the displayed page.

defined, the message:

>   PAGE SPECIFICATION **ERROR:NO** MNEMONIC NAME SPECIFIED

shall be generated and command processing terminated; if more than four positional parameters are defined, the message:

>   PAGE SPECIFICATION **ERROR:TOO** MANY POSITIONAL PARAMETERS

shall be generated and command processing terminated.

The specified mnemonic name is checked as follows. If more than six characters are specified, the message:

>   PAGE SPECIFICATION **ERROR:mnemonic** IS GREATER THAN SIX CHARACTERS

shall be generated and command processing terminated. The mnemonic shall be compared with the list of previously defined mnemonics and the list of commands and subcommands. If a match is found, the message:

>   PAGE SPECIFICATION ERROR, mnemonic WAS PREVIOUSLY DEFINED

>   **AS A** MNEMONIC
>   COMMAND
>   SUBCOMMAND

shall be displayed and command processing terminated.

The values of 'lines' and 'columns' shall be tested and if an error has occurred, the message:

>   PAGE SPECIFICATION ERROR, value IS NOT A VALID VALUE

>   FOR LINES   VALUE MUST BE A POSITIVE INTEGER
>   COLUMNS

where 'value' is the invalid input shall be generated, and command processing terminated.

The mnemonics specified for **PP** and **NP** shall be tested for length, a zero length shall be ignored and a length greater than six characters cause he following message:

PAGE SPECIFICATION ERROR, mnemonic IS GREATER THAN SIX
CHARACTERS

Command processing shall then terminate. The value of the specified
mnemonic names shall be checked against the list of defined mnemonic names,
if no match is found, the message:

PAGE SPECIFICATION **WARNING:mnemonic** IS NOT CURRENTLY DEFINED PAGE
MNEMONIC

shall be displayed and command processing terminated.

1-20.3.4.3.1.5 Quality Assurance Provisions.- This procedure shall be
tested by entering command input in valid and invalid form. All error
traps described in Section **1-20.3.4.3.1.4** shall be exercised. Results of
valid and invalid input shall be observed by displaying the page table of
contents as described in Section **1-20.3.4.4.1.** Valid input must result in
an addition to the table of contents, invalid input must result in no
changes or additions.

1-20.3.4.3.2 Procedure 2 - Content Description.- This procedure allows the
user to define the data elements which will appear on a page.

1-20.3.4.3.2.1 External **Inputs.-** The syntax of the Specify Page Content
command shall be:

> **SPC,** mnemonic, [MODEL = page]

where 'mnemonic' is the name of a previously defined page and 'page' is the
name of another page whose content is to be used as a model for the current
content description.

1-20.3.4.3.2.2 Functional **Processing.-** The description for a page shall be
specified by the list **SYS:PAGE.mnemonic.** If no list has been previously
created for the specified page, a list description shall be created and the
user prompted for input. If a 'model' page is specified, the content
description for that page shall be copied to the newly created list. The
format of the page content description shall be:

data element, LINE = starting line, **COL** = starting columns,
DESIGNATOR = display format designator, [LENGTH = field length]

where 'data element' is the fully qualified data element name of the item
to be displayed. The keywords LINE and **COL** shall designate the starting
line and column of the displayed field.

PAGE SPECIFICATION ERROR, mnemonic IS GREATER THAN SIX
CHARACTERS

Command processing shall then terminate. The value of the specified
mnemonic names shall be checked against the list of defined mnemonic names,
if no match is found, the message:

PAGE SPECIFICATION **WARNING:mnemonic** IS NOT CURRENTLY DEFINED PAGE
MNEMONIC

shall be displayed and command processing terminated.

1-20.3.4.3.1.5 Quality Assurance Provisions.- This procedure shall be
tested by entering command input in valid and invalid form. All error
traps described in Section **1-20.3.4.3.1.4** shall be exercised. Results of
valid and invalid input shall be observed by displaying the page table of
contents as described in Section **1-20.3.4.4.1.** Valid input must result in
an addition to the table of contents, invalid input must result in no
changes or additions.

1-20.3.4.3.2 Procedure 2 - Content Description.- This procedure allows the
user to define the data elements which will appear on a page.

1-20.3.4.3.2.1 External **Inputs.-** The syntax of the Specify Page Content
command shall be:

> **SPC,** mnemonic, [MODEL = page]

where 'mnemonic' is the name of a previously defined page and 'page' is the
name of another page whose content is to be used as a model for the current
content description.

1-20.3.4.3.2.2 Functional **Processing.-** The description for a page shall be
specified by the list **SYS:PAGE.mnemonic.** If no list has been previously
created for the specified page, a list description shall be created and the
user prompted for input. If a 'model' page is specified, the content
description for that page shall be copied to the newly created list. The
format of the page content description shall be:

data element, LINE = starting line, **COL** = starting columns,
DESIGNATOR = display format designator, [LENGTH = field length]

where 'data element' is the fully qualified data element name of the item
to be displayed. The keywords LINE and **COL** shall designate the starting
line and column of the displayed field.

1-20.3.4.3.2.5 Quality Assurance Provisions.- This procedure shall be verified by entering valid and invalid page nmemonics, valid and invalid data element names and valid and invalid MODEL names. The results of input shall be verified by redisplaying the content list.

1-20.3.4.3.3 Procedure 3 - Format Description.- This procedure allows the user to geographically specify the format of a display page.

1-20.3.4.3.3.1 External Inputs.- The syntax of the Specify Page Format command shall be:

> SPF, mnemonic, [MODEL = page]

where 'mnemonic' is the name of a previously specified page and 'page' is the name of another page whose format is to be used as a model for the current content description.

1-20.3.4.3.3.2 Functional Processing.- Upon entry of the SPF command, the display shall be cleared and any currently located data elements shall have their positions on the display marked by their designator sequence (as defined in the DESIGNATOR keyword in Section **1-20.3.4.3.2.2**). If MODEL is specified, the model page's description shall be copied to 'mnemonic's'.

Until all data elements specified in the content list have been located on the page, the following shall take place:

(a) The first data element in the content list which has no location assigned shall have its name and length displayed on line **2.**

(b) The user shall place the cursor at the desired starting location of the data element and hit a carriage return (CR).

(c) The system shall update the content list to include the corresponding LINE and **COL** location parameters.

(d) The system shall fill the indicated field on the display with the data elements designator.

(e) The system shall prompt the user with:

ENTER 'R' TO RELOCATE OR HIT CARRIAGE RETURN TO CONTINUE WITH NEXT DATA ELEMENT

(f) The user shall respond.

(g) The system shall repeat from **(b)** for **'R'** or (a) for (CR).

This process shall continue until all unlocated data elements have been positioned or until the user enters a subcommand escape **(↑A).**

The user shall then be prompted to enter a data element name. The position designator of the specified data element shall be inverted and the user allowed to move the data element to a new location by positioning the cursor and hitting a carriage return.

The user may save an intermediate version of the page content list by entering subcommand escape **(↑A)** and then entering: **≫ SAV.**

The user shall terminate processing (and save the list) by entering an escape command **(ESC).**

The user may terminate processing with no list saved by entering a subcommand escape **(↑ A)** and then entering **≫ ABO.**

The user may save an intermediate version of the page content list by entering a subcommand escape **(↑ A)** and then entering **≻ ≻ SAV.**

1-20.3.4.3.3.3 External **Outputs.-** The updated Page Content List shall be written out to permanent storage.

1-20.3.4.3.3.4 Error Processing.- If no content list exists for 'mnemonic', the message:

     PAGE DEFINITION ERROR: NO CONTENT LIST EXISTS FOR 'mnemonic'.

shall be displayed and command processing terminated.

Variable length data elements must begin in column one and occupy at least one full line. If the cursor is placed any where on a line containing a previously defined display field, the message:

     WARNING: name IS A VARIABLE LENGTH ELEMENT AND MUST HAVE A FULL LINE

shall be displayed and the data element name prompt redisplayed.

1-20.3.4.3.3.5 Quality Assurance Provisions.- This procedure shall be verified by entering valid and invalid mnemonic names, MODEL names, and data element names. All positioning functions shall be exercised and verified by redisplaying the content list and examining the LINE, **COL,** and LENGTH values.

1-20.3.4.4 Function 2 - Page Displays.- This function describes the following procedures:

        Display single page
        Display multiple pages

1-20.3.4.4.1 Procedure 1 - Display **Page**.- This procedure allows the user to display the contents of any single page.

1-20.3.4.4.1.1 External Inputs.- The syntax of the display page command shall be:

        mne

where 'we' is the mnemonic name of the desired page. This command differs from all other commands in that no explicit command name shall be required.

1-20.3.4.4.1.2 Functional Processing.- The display page command shall be implemented by concatenating the page mnemonic list to the command list and treating the input mnemonic as a command. The result of the command shall be the assembly and display of the specified page on the users console.

The following set of **commands** shall be defined for all display page mnemonics:

        PP - Page up one logical page
        NP - Page down one logical page
        PU - Page up one display **subpage**
        PD - Page down one display **subpage**

PP and **NP** shall page up or down to the logical predecessor or successor pages defined in the page definition (see Section **1-20.3.4.3.1.1).** These commands shall be valid at any time a page is being displayed.

PU and **PD** shall allow partial paging of pages which exceed the length of he display device. The attributes of the maintenance, Cab, and **TRACON SMDs** shall be defined by adaptation data elements stored under the family name ADAPT.

1-20.3.4.3.3.5 <u>Quality Assurance Provisions.</u>- This procedure shall be verified by entering valid and invalid mnemonic names, MODEL names, and data element names. All positioning functions shall be exercised and verified by redisplaying the content list and examining the LINE, **COL,** and LENGTH values.

1-20.3.4.4 <u>Function 2 - Page Displays.</u>- This function describes the following procedures:

      Display single page
      Display multiple pages

1-20.3.4.4.1 <u>Procedure 1 - Display **Page**.</u>- This procedure allows the user to display the contents of any single page.

1-20.3.4.4.1.1 <u>External Inputs.</u>- The syntax of the display page command shall be:

      mne

where 'we' is the mnemonic name of the desired page. This command differs from all other commands in that no explicit command name shall be required.

1-20.3.4.4.1.2 <u>Functional Processing.</u>- The display page command shall be implemented by concatenating the page mnemonic list to the command list and treating the input mnemonic as a command. The result of the command shall be the assembly and display of the specified page on the users console.

The following set of commands shall be defined for all display page mnemonics:

      PP - Page up one logical page
      NP - Page down one logical page
      PU - Page up one display **subpage**
      PD - Page down one display **subpage**

PP and **NP** shall page up or down to the logical predecessor or successor pages defined in the page definition (see Section **1-20.3.4.3.1.1).** These commands shall be valid at any time a page is being displayed.

PU and **PD** shall allow partial paging of pages which exceed the length of he display device. The attributes of the maintenance, Cab, and **TRACON SMDs** shall be defined by adaptation data elements stored under the family name ADAPT.

1-20.3.4.4.1.5 <u>Quality Assurance Provisions</u>.- This procedure shall be verified by requesting valid and invalid pages. The **PP, NP, PD,** and **PU** commands shall be verified and line wrap around tested.

1-20.3.4.4.2 <u>Procedure 2 - Multiple Page Displays</u>.- This procedure **allows** the display of multiple pages on an **SMD.**

1-20.3.4.4.2.1 <u>External Inputs.</u>- The maintenance, CAB, or **TRACON SMD** user may request the display of multiple pages of data by using an extended version of the single page display command. The syntax of this command shall be:

     mne 1, mne 2, [..., mne n,] [TOP] **[NOTOP]**

where 'mne 1' through 'mne n' shall represent the page mnemonics requested for display. The keyword TOP shall indicate that columns are to begin with page tops where possible. TOP shall be the default, **NOTOP** shall disable this feature.

1-20.3.4.4.2.2 <u>Functional Processing</u>.- The pages specified by the user input mnemonics shall be assembled for display as **follows:** The user's console size shall be determined from the screen specification adaptation data (see Section **1-20.3.4.4.1.2)** and the size of the specified pages determined from the page table of contents.

The first page requested **(mne 1)** shall be displayed beginning in column 1 of line **2.** If the page length exceeds the available physical display length, the page shall be continued in a second, third, or **nth** display column. The display column width shall be determined by, and be equal to, the maximum page width for any of the specified pages, display columns shall be separated by a single column of blanks. If the page width exceeds the maximum possible display width, the page shall be allowed to wrap around on a line by line basis.

If **NOTOP** is specified, subsequent pages shall be displayed immediately following the last line of the previous page with a single blank line separator. IF TOP is specified, the **following** procedure shall be **followed:**

    (a) If the next complete page may be displayed in the current column, it is.

(b) If the next complete page requires continuation on a new column, it is begun at the top (line 2) of that column.

(c) If a page, other than the first page of a display requires more space than is currently available in the display, the page is not displayed. In this case, the word 'MORE' is displayed in the Prompt field of line 1.

(d) A single page which requires more than one full display is always begun in column 1, line 2, and the 'MORE' prompt displayed.

The commands PP, NP, PU, shall be defined as specified in Section 1-20.3.4.4.2.2. For the multiple page display, the user's input shall temporarily define the logical page order for PP and NP, e.g., NP the logical successor to 'mne n'. PP shall result in the addition of the predecessor of 'mne 1' and the deletion of 'we n'. The temporary ordering specified by the command input shall be retained under repeated PU and PD operations. PU and PD shall page up or down one complete display, independent of logical page boundaries.

1-20.3.4.4.2.3 External Outputs.- As specified above, Figure 3-2 provides an example.

1-20.3.4.4.2.4 Error Processing.- The following error processing shall be performed: The input page mnemonic list shall be tested against the page mnemonics listed in the page table of contents. If an undefined mnemonic is found, the message:

    PAGE DISPLAY ERROR: mne IS NOT A DEFINED PAGE MNEMONIC

shall be generated and command processing terminated.

1-20.3.4.4.2.5 Quality Assurance Provisions.- This procedure shall be verified by inputting valid and invalid lists of page mnemonics and observing the results. Valid page mnemonic lists shall be generated to exercise all functions described in Secton 1-20.3.4.4.2.2. The PP, NP, PU, and PD commands shall be tested.

1-20.3.5 Demonstrable Unit 3 - Supervisory/Maintenance Display.- This DU describes the following functions:

    Log On/Log Off
    Alert and Alarm
    Supplementary Page assignment

(b) If the next complete page requires continuation on a new
column, it is begun at the top (line 2) of that column.

(c) If a page, other than the first page of a display requires more
space than is currently available in the display, the page is not
displayed. In this case, the word 'MORE' is displayed in the Prompt
field of line 1.

(d) A single page which requires more than one full display is
always begun in column 1, line 2, and the 'MORE' prompt displayed.

The commands PP, NP, PU, shall be defined as specified in Section
1-20.3.4.4.2.2. For the multiple page display, the user's input shall
temporarily define the logical page order for PP and NP, e.g., NP the
logical successor to 'mne n'. PP shall result in the addition of the
predecessor of 'mne 1' and the deletion of 'we n'. The temporary ordering
specified by the command input shall be retained under repeated PU and PD
operations. PU and PD shall page up or down one complete display,
independent of logical page boundaries.

1-20.3.4.4.2.3 External Outputs.- As specified above, Figure 3-2 provides
an example.

1-20.3.4.4.2.4 Error Processing.- The following error processing shall be
performed: The input page mnemonic list shall be tested against the page
mnemonics listed in the page table of contents. If an undefined mnemonic
is found, the message:

    PAGE DISPLAY ERROR: mne IS NOT A DEFINED PAGE MNEMONIC

shall be generated and command processing terminated.

1-20.3.4.4.2.5 Quality Assurance Provisions.- This procedure shall be
verified by inputting valid and invalid lists of page mnemonics and
observing the results. Valid page mnemonic lists shall be generated to
exercise all functions described in Secton 1-20.3.4.4.2.2. The PP, NP, PU,
and PD commands shall be tested.

1-20.3.5 Demonstrable Unit 3 - Supervisory/Maintenance Display.- This DU
describes the following functions:

    Log On/Log Off
    Alert and Alarm
    Supplementary Page assignment

1-20.3.5.3.1.4 Error Processing.- The following error checks shall be performed: The input 'userid' shall be checked against the valid user identifications specified in the password list (see Section **1-20.3.5.3.2).** If no match is found, the message:

     LOGON REJECTED, **userid** IS NOT A VALID **USERID**

shall be displayed and a new command prompt **displayed.** The password entered by the user shall be checked against the list of valid passwords for **'userid'.** If no match is found, the message

     LOGON REJECTED, INVALID PASSWORD

shall be displayed and a new command prompt displayed.

1-20.3.5.3.1.5 Quality Assurance Provisions.- This procedure shall be verified by entering **LOGONs** in valid and invalid form. All error traps described above shall be exercised.

1-20.3.5.3.2 Procedure 2 **- Userid/Password** Assignment.- This procedure describes the assignment of **SMD userid's** and passwords. The Family **SYS** shall contain a permanent list called **SYS:LIST_OF_PASSWORDS.** The format of this list shall be:

     user identifier, **PASSWORD=user's password,LEVEL=protection** level

where 'user identifier' is a 1 to 8 character unique user identification. The value of PASSWORD shall be a 1 to 8 character password to be associated with 'user identifier'. LEVEL shall designate the protection level assigned to PASSWORD and may be **Ø, 1,** or 2 (defaulting to **1).** All of the above fields shall be mandatory.

If it is necessary to assign more than one level of protection to a user, multiple passwords shall be used. A separate line shall be used to define each password, **e.g.:**

     SMITH, PASSWORD = JOHN **1,** LEVEL = 1
     SMITH, PASSWORD = JOHN **2,** LEVEL = 2

shall define two passwords for 'SMITH' one with LEVEL = 1 protection and one with LEVEL = **2.**

1-20.3.5.3.2.1 <u>External Inputs</u>.- The user input for this procedure shall be via the modify list (ML) command described in Section **1-20.3.3.4.**

1-20.3.5.3.2.2 <u>Functional Processing</u>.- No special processing is required for this procedure.

1-20.3.5.3.2.3 <u>External **Outputs.-**</u> The updated password list shall be written out to permanent storage.

1-20.3.5.3.2.4 <u>Error Processing.</u>- No special error processing is required for this procedure.

1-20.3.5.3.2.5 <u>Quality Assurance Provisions</u>.- This procedure shall be verified by adding **userids** and passwords to the list and displaying the resultant list.

1-20.3.5.3.3 <u>Procedure 3 **-** **SMD** Logoff</u>**.-** This procedure describes the **SMD** LOGOFF command.

1-20.3.5.3.3.1 <u>External Inputs</u>**.-** The user will enter the Logoff command on an **SMD.** The command syntax shall be: **> <u>L</u>OGOFF**

1-20.3.5.3.3.2 <u>Functional Processing</u>.- The current console protection level shall be set to **∅.**

1-20.3.5.3.3.3 <u>External Outputs.</u>- The message:

    userid LOGGED OFF, PROTECTION SET TO **∅**

shall be displayed,, here **'userid'** is the user identification associated with the currently logged on user.

1-20.3.5.3.3.4 <u>Error Processing</u>.- If no user is currently logged on, the message:

    NO USER LOGGED ON

shall be displayed and a new command prompt generated.

1-20.3.5.3.3.5 <u>Quality Assurance Provisions</u>.- This procedure shall be tested with a user logged on and logged off and the resultant messages checked. Password level reset shall be verified by attempting Level 1 and 2 functions after a LOGOFF and observing the results.

1-20.3.5.3.2.1 External Inputs.- The user input for this procedure shall be via the modify list (ML) command described in Section **1-20.3.3.4.**

1-20.3.5.3.2.2 Functional Processing.- No special processing is required for this procedure.

1-20.3.5.3.2.3 External **Outputs.-** The updated password list shall be written out to permanent storage.

1-20.3.5.3.2.4 Error Processing.- No special error processing is required for this procedure.

1-20.3.5.3.2.5 Quality Assurance Provisions.- This procedure shall be verified by adding **userids** and passwords to the list and displaying the resultant list.

1-20.3.5.3.3 Procedure 3 **- SMD** Logoff.- This procedure describes the **SMD** LOGOFF command.

1-20.3.5.3.3.1 External Inputs.- The user will enter the Logoff command on an **SMD.** The command syntax shall be: **> LOGOFF**

1-20.3.5.3.3.2 Functional Processing.- The current console protection level shall be set to Ø.

1-20.3.5.3.3.3 External Outputs.- The message:

     userid LOGGED OFF, PROTECTION SET TO Ø

shall be displayed,, here 'userid' is the user identification associated with the currently logged on user.

1-20.3.5.3.3.4 Error Processing.- If no user is currently logged on, the message:

     NO USER LOGGED ON

shall be displayed and a new command prompt generated.

1-20.3.5.3.3.5 Quality Assurance Provisions.- This procedure shall be tested with a user logged on and logged off and the resultant messages checked. Password level reset shall be verified by attempting Level 1 and 2 functions after a LOGOFF and observing the results.

The alternate form:

    ALERT = ((display 1, display 2,..., display n), alert character,
             alert message, [B][R][U]))

may be used and shall specify that display 1 through n are to be assigned
the same alert characteristics.

1-20.3.5.4.1.2 Functional **Processing.-** The special function software
defined for the Dat· Element Member Description List shall perform the
error checking spe.fied in Section **1-20.3.5.4.1.4.**

1-20.3.5.4.1.3 Ext.rnal Outputs.- After the user has completed modifying
the data element definition list, it shall be written out to permanent
storage.

1-20.3.5.4.1.4 Error **Processing.-** The following error checks shall be
performed: The display names specified shall be checked against the
symbolic name fields in the display configuration list **SYS:CONFIGURATION.**
If an undefined name is found, the error message:

    DATA ELEMENT **DEFINTION ERROR:display** IS NOT A SPECIFIED DEVICE ON THIS
    SYSTEM

shall be displayed and the entire user input line shall be flushed.

The data element names specified in the 'alert message' field shall be
checked against the list of defined data elements. If an undefined name is
found, the error message:

    DATA ELEMENT DEFINITION **ERROR:alert** message IS NOT A DEFINED DATA
    ELEMENT

shall be displayed and the entire user input line flushed.

1-20.3.5.4.1.5 Quality Assurance Provisions.- This procedure shall be
verified by specifying valid and invalid ALARM and ALERT parameters. All
specified error checks shall be exercised. The resultant-ALARM and ALERT
parameters shall be redisplayed and checked against input.

<u>1-20.3.5.4.2 Procedure 2 - Display of Console Alarms and Alerts</u>.-
This procedure describes the generation and display of Cab, **TRACON,** and
maintenance console Alarms and Alerts.

1-20.3.5.4.2.1 <u>External Inputs</u>.- An **Alerm** or Alert shall be generated at a
specific console whenever the content of a data element (whose ALARM and/or
ALERT parameters specify that console's address) changes.

1-20.3.5.4.2.2 <u>Functional Processing.</u>- The Alarm condition shall cause the
console audible alarm to be sounded. The Alert condition shall initiate
the following special processing:

The Alert Character specified shall be placed on the Alert Display Field
quere. The contents **fo** this queue shall be displayed, left to right, on a
FIFO basis, in the Alert Display Field described in Section **1-20.3.3.3.1.**
Up to **10** characters may be displayed in this field, if queue overflow
occurs, the oldest character shall be deleted and the new character
displayed.

The content of the Alert Message data element shall be copied to an
instance of the data element **ALERT:MESSAGES.**

1-20.3.5.4.2.3 <u>External **Outputs**</u>.- Audible Alarms and Alerts as described
above.

1-20.3.5.4.2.4 <u>Error Processing.</u>- No specific error processing is
required.

1-20.3.5.4.2.5 <u>Quality Assurance Provisions</u>.- This procedure shall be
tested by using the ED command (see Section **1-20.3.3.5.1)** to change the
content of data elements with ALARM and ALERT parameters specified. The
results will be observed on all designated display devices.

1-20.3.5.4.3 <u>Procedure 3 - Acknowledgments of Console Alarms and **Alerts**</u>.-
This procedure describes the **SMD** user's ALARM and ALERT response
procedures.

1-20.3.5.4.3.1 <u>External Inputs</u>.- The user shall respond to an ALARM or
ALERT condition on his **SMD** by displaying the message associated with the
ALARM or ALERT. The syntax of the display alert command shall be:

> <u>**DA**</u> [alert character], [ALL]

where 'alert character' is one of the single ASCII characters displayed in
the Alert Field of the user's console. ALL is **an optional** keyword which
specifies that all alert messages shall be displayed.

1-20.3.5.4.2 Procedure 2 - Display of Console Alarms and Alerts.-
This procedure describes the generation and display of Cab, **TRACON,** and
maintenance console Alarms and Alerts.

1-20.3.5.4.2.1 External Inputs.- An **Alerm** or Alert shall be generated at a
specific console whenever the content of a data element (whose ALARM and/or
ALERT parameters specify that console's address) changes.

1-20.3.5.4.2.2 Functional Processing.- The Alarm condition shall cause the
console audible alarm to be sounded. The Alert condition shall initiate
the following special processing:

The Alert Character specified shall be placed on the Alert Display Field
quere. The contents **fo** this queue shall be displayed, left to right, on a
FIFO basis, in the Alert Display Field described in Section **1-20.3.3.3.1.**
Up to **10** characters may be displayed in this field, if queue overflow
occurs, the oldest character shall be deleted and the new character
displayed.

The content of the Alert Message data element shall be copied to an
instance of the data element **ALERT:MESSAGES.**

1-20.3.5.4.2.3 External **Outputs.-** Audible Alarms and Alerts as described
above.

1-20.3.5.4.2.4 Error Processing.- No specific error processing is
required.

1-20.3.5.4.2.5 Quality Assurance Provisions.- This procedure shall be
tested by using the ED command (see Section **1-20.3.3.5.1)** to change the
content of data elements with ALARM and ALERT parameters specified. The
results will be observed on all designated display devices.

1-20.3.5.4.3 Procedure 3 - Acknowledgments of Console Alarms and **Alerts.-**
This procedure describes the **SMD** user's ALARM and ALERT response
procedures.

1-20.3.5.4.3.1 External Inputs.- The user shall respond to an ALARM or
ALERT condition on his **SMD** by displaying the message associated with the
ALARM or ALERT. The syntax of the display alert command shall be:

> **DA** [alert character], [ALL]

where 'alert character' is one of the single ASCII characters displayed in
the Alert Field of the user's console. ALL is **an optional** keyword which
specifies that all alert messages shall be displayed.

The acknowledgment of the last alert in the queue shall **cuase** the deletion of the corresponding 'alert character' for that **SMD.**

The acknowledgment of an ALARM or ALERT on an **SMD** shall not affect the same ALARM or ALERT for another **SMD.**

1-20.3.5.4.3.3 External Outputs.- Alert message data elements shall be displayed starting in column 1 of the line following the user's DA command. The first DA shall cause the screen to be cleared, consecutive DA's shall not clear the screen until display of the latest message would cause screen overflow.

Alert acknowledgment shall be recorded on the system recording device. The acknowledgment recording shall include the user's command, the user's **SMD** address, and the resultant message and a time tag.

1-20.3.5.4.3.4 Error Processing.- The following error checking shall be performed:

    If the alert message queue is empty, the following message shall be displayed:

    NO OUTSTANDING ALERT MESSAGES

If an 'alert character' is specified and a search of the queue finds no corresponding messages, the following error message shall be displayed:

    NO OUTSTANDING letter MESSAGES

In **event** of error, normal keyboard logging shall be done, but no special acknowledgment record shall be made.

1-20.3.5.4.3.5 Quality Assurance Provisions.- This Procedure shall be verified by generating alerts with the ED command as was done for Procedure **2.** Valid and invalid DA commands shall be entered and the resultant displays verified. The above error checks shall be verified and repeated display of the same message shall be attempted to verify deletion of the alert message. The data recording stub shall print out acknowledgement messages for verification. This Procedure shall be reverified when data recording is implemented.

1-20.3.5.4.4 Procedure 4 - Display of Supplementary Display Alarms and **Alerts.-** This procedure describes the display of Alarms and Alerts on the Supplementary Displays.

1-20.3.5.4.4.1 External Inputs.- An Alarm or Alert shall be generated at a specific Supplementary Display whenever the content of a data element (whose ALARM and/or ALERT parameters specify that Displays address) changes.

1-20.3.5.4.4.2 Functional Processing.- The Alarm condition shall cause Supplementary Display audible alarm to be sounded. The Alert condition shall initiate the following special processing:

The Alert processing software shall first verify that the logical device name specified in the ALERT parameter is currently assigned to a physical device, and that the data element causing the alert is displayed on one of the pages assigned to that device. If these conditions are satisfied, the message 'PAGE n' shall be displayed in the Alert field of each page header of the display and the affected data element shall be highlighted using the special display feature(s) specified in the **'BRU'** parameter (see Section **1-20.3.5.4.1).**

Multiple Alarms and Alerts to a given device shall be treated as follows:

Alarms shall be sounded upon change of data. Alerts shall be **enqueued** on a first in first out (FIFO) basis for prompting purposes. Actual highlighting of fields shall be accomplished on change of data.

1-20.3.5.4.4.3 External Outputs.- 'PAGE n' shall be displayed in the Alert field of each page. **'n'** shall designate the page number (in Supplementary Display memory) on which the Alerted data element appears.

1-20.3.5.4.4.4 Error Processing.- No explicit error processing shall be performed.

1-20.3.5.4.4.5 Quality Assurance Provisions.- This procedure shall be tested using the ED command (see Section 1-20.3.3.5.1) to change the content of data elements with ALARM and ALERT parameters specified. The results will be observed on a designated and a nondesignated Supplementary Display device.

1-20.3.5.4.5 Procedure 5 - Acknowledgment of Supplementary Alarms and Alerts.- This procedure describes the user's response to and acknowledgment of Alarms and Alerts.

1-20.3.5.4.5.1 External Inputs.- The user shall respond to an Alarm by pressing the Acknowledge Button associated with his Supplementary Display. This action shall silence the alarm. The user shall then observe the associated Alert and proceed with the Alert response procedure.

The user shall respond to an Alert by displaying the page indicated in his Supplementary Display Alert field. Upon observing the highlighted data, he shall respond by pressing the Acknowledge Button.

1-20.3.5.4.5.2 Functional Processing.- An acknowledgment received while an Alarm is sounding, shall be recorded as an Alarm Acknowledgment. Alert acknowledgment shall be processed as follows: When an Acknowledge is received during a period in which no Alarm is being sounded, the displayed page is sensed and all highlighting on that page is suppressed. All entries for that page number in the Alert Field queue shall be deleted and the acknowledgment recorded.

1-20.3.5.4.5.3 External Outputs.- An Alarm Acknowledgment shall be recorded on the system recording device. The Acknowledgment record shall include the Alarmed data element name, the Supplementary Display device address, and a time tag. An Alert Acknowledgment shall be recorded whenever an Alert response is received; this Acknowledgment record shall include the Supplementary Display device address, the currently displayed page number and mnemonic, the names of all Alerted data elements, and a time tag.

1-20.3.5.4.5.4 Error Processing.- None, Acknowledgments received while no data elements are in Alarm or Alert status shall be ignored.

1-20.3.5.4.5.5 Quality Assurance Provisions.- This procedure shall be verified by generating alerts with the ED command (see Section 1-20.3.3.5.1) as was done for Procedure 2. Acknowledgment messages shall be printed out by the data recording stub for verification. This Procedure shall be reverified when data recording is implemented.

1-20.3.5.5 Function 3 - Page and Device Assignment.- This Function allows the user to assign pages to logical devices, logical devices to physical devices, and to select a configuration. Two procedures are defined:

1-20.3.5.4.5 Procedure 5 - Acknowledgment of Supplementary Alarms and Alerts.- This procedure describes the user's response to and acknowledgment of Alarms and Alerts.

1-20.3.5.4.5.1 External Inputs.- The user shall respond to an Alarm by pressing the Acknowledge Button associated with his Supplementary Display. This action shall silence the alarm. The user shall then observe the associated Alert and proceed with the Alert response procedure.

The user shall respond to an Alert by displaying the page indicated in his Supplementary Display Alert field. Upon observing the highlighted data, he shall respond by pressing the Acknowledge Button.

1-20.3.5.4.5.2 Functional **Processing.-** An acknowledgment received while an Alarm is sounding, shall be recorded as an Alarm Acknowledgment. Alert acknowledgment shall be processed as follows: When an Acknowledge is received during a period in which no Alarm is being sounded, the displayed page is sensed and all highlighting on that page is suppressed. All entries for that page number in the Alert Field queue shall be deleted and the acknowledgment recorded.

1-20.3.5.4.5.3 External Outputs.- An Alarm Acknowledgment shall be recorded on the system recording device. The Acknowledgment record shall include the Alarmed data element name, the Supplementary Display device address, and a time tag. An Alert Acknowledgment shall be recorded whenever an Alert response is received; this Acknowledgment record shall include the Supplementary Display device address, the currently displayed page number and mnemonic, the names of all Alerted data elements, and a time tag.

1-20.3.5.4.5.4 Error **Processing.-** None, Acknowledgments received while no data elements are in Alarm or Alert status shall be ignored.

1-20.3.5.4.5.5 Quality Assurance Provisions.- This procedure shall be verified by generating alerts with the ED command (see Section 1-20.3.3.5.1) as was done for Procedure **2.** Acknowledgment messages shall be printed out by the data recording stub for verification. This Procedure shall be reverified when data recording is implemented.

1-20.3.5.5 Function 3 - Page and Device Assignment.- This Function allows the user to assign pages to logical devices, logical devices to physical devices, and to select a configuration. Two procedures are defined:

1-20.3.5.5.1.4 Error Processing.- The following error checks shall be performed:

Whenever a new assignment is added to the list, the physical device name shall be checked against the list of physical devices. If the device does not exist, the error message:

DEVICE ASSIGNMENT **ERROR:device** name NON EXISTENT

shall be displayed, the input rejected, and a new ML subcommand prompt generated. The page mnemonic name shall be checked against the page table of contents. If no such page exists, the message:

PAGE ASSIGNMENT **ERROR:page** mnemonic NOT IN TABLE OF CONTENTS

shall be displayed, the input rejected, and a new ML subcommand prompt generated.

1-20.3.5.5.1.5 Quality Assurance Provisions.- This procedure shall be verified by defining and displaying new configuration lists, by assigning logical devices to valid and invalid physical devices, by deleting unassigned devices, and attempting to delete assigned devices.

1-20.3.5.5.2 Procedure 2 **–** Select Supplementary Display **Configuration.–** This procedure describes the Select-Supplementary Display Configuration **(SS)** command.

1-20.3.5.5.2.1 External **Inputs.–** To select a specific **predefined** logical display configuration, the user shall input the Specify Configuration (SC) command. The syntax of the configuration shall be:

SS, configuration name

where 'configuration name' is the final qualifier of a previously specified supplementary display configuration list name.

1-20.3.5.5.2.2 Functional Processing.- The configuration list **SYS:SD_** CONFIGURATION. 'configuration name' shall be used to generate the system I/O device configuration table.

1-20.3.5.5.2.3 External Outputs.- The message:

SUPPLEMENTARY DISPLAY CHANGED TO configuration name shall be displayed.

1-20.3.5.5.2.4 Error Processing.- The following error checks shall be performed. The designated configuration list name shall be checked against the list of lists. If it has not been previously defined, the message:

        SD CONFIGURATION **ERROR:configuration** name NOT DEFINED

shall be displayed and a new command prompt generated.

If the list has been defined, but is empty, the message:

        SD CONFIGURATION **ERROR:configuration** name SPECIFIES NO DEVICE
        ASSIGNMENTS

shall be displayed and a new **command** prompt generated.

1-20.3.5.5.2.5 Quality Assurance Provisions.- This procedure shall be verified by inputting valid and invalid configuration names in the SC command. All error checks defined above shall be exercised and results of valid and invalid input will be observed on assigned and unassigned physical devices.

1-20.3.6 Demonstrable Unit 4 - Data Recording and Simulation

1-20.3.6.1 Functional Capabilities Description.- This **DU** provides the capability of recording data, logging events, recording the system state, and printing Remote Maintenance Monitor hardcopy reports during system operation. In an offline mode, or as a low priority task in realtime, it provides the capability of generating a simulation file, in order to permit testing of the software prior to integration with remote site **FPUs.** The specific functions to be demonstrated are:

        Data Recording
        Generate Simulation Data File
        Manually Initiated Recording of System State
        RMM Hardcopy Reports

Data shall be recorded on disk in realtime and flushed to tape in a background mode of operation. Data recorded on the recording tape shall consist of a header, snapshots of the system state, input messages from external equipment, Service A and operator positions, output messages to external equipment, and alerts to the operator. Computer system events shall also be logged on the recording tape.

The simulation file (optionally, disk or tape file) shall contain a header and simulated input messages from external equipment and Service A. These simulated input messages shall be in the same format as the recorded input messages on the recording tape.

The **RMM** hardcopy reports shall be printer images of the display data page the maintenance **SMD** operator is currently viewing on his maintenance console. When requested, this image shall be printed on the line printer.

1-20.3.6.2 System Components Required.- **CPS, CPS** operators console, and maintenance console.

1-20.3.6.3 Other Demonstrable Units Required.- **DU1, DU2,** and **DU3.**

1-20.3.6.4 Function 1 - Maintenance Hardcopy Reports

1-20.3.6.4.1 External Inputs

> Hardcopy display request command (>**HD**).
> Internal image of maintenance **SMD.**

1-20.3.6.4.2 Functional Processing.- In response to a hardcopy display request command, this function shall convert the internal image within the **CPS** of the maintenance **SMD** to printer characters, and output it to the System printer.

1-20.3.6.4.3 External Outputs

> Hardcopy of maintenance **SMD.**
> Error messages.

1-20.3.6.4.4 Error Processing.- If the system printer is not available, the **following** message shall be output to the maintenance console:

> PRINTER NOT READY

If the system printer is unable to **complete** output in the expected time interval, the following message shall be output to the **maintenance** console:

> OUTPUT INCOMPLETE

Either of these conditions shall end the output attempt.

The simulation file (optionally, disk or tape file) shall contain a header and simulated input messages from external equipment and Service A. These simulated input messages shall be in the same format as the recorded input messages on the recording tape.

The **RMM** hardcopy reports shall be printer images of the display data page the maintenance **SMD** operator is currently viewing on his maintenance console. When requested, this image shall be printed on the line printer.

1-20.3.6.2 System Components Required.- **CPS, CPS** operators console, and maintenance console.

1-20.3.6.3 Other Demonstrable Units Required.- **DU1, DU2,** and **DU3.**

1-20.3.6.4 Function 1 - Maintenance Hardcopy Reports

1-20.3.6.4.1 External Inputs

> Hardcopy display request command (>**HD**).
> Internal image of maintenance **SMD.**

1-20.3.6.4.2 Functional Processing.- In response to a hardcopy display request command, this function shall convert the internal image within the **CPS** of the maintenance **SMD** to printer characters, and output it to the System printer.

1-20.3.6.4.3 External Outputs

> Hardcopy of maintenance **SMD.**
> Error messages.

1-20.3.6.4.4 Error Processing.- If the system printer is not available, the **following** message shall be output to the maintenance console:

> PRINTER NOT READY

If the system printer is unable to **complete** output in the expected time interval, the following message shall be output to the **maintenance** console:

> OUTPUT INCOMPLETE

Either of these conditions shall end the output attempt.

where:

message is the ASCII message including a prefixed message ID.
sensor is the address of the sensor being simulated.
start is the start time in hours, minutes, and seconds.
stop is the stop tine in hours, minutes, and seconds.
rate is the repetition rate in seconds (zero indicates once which is default).
cycle is the unique event number of the first message (0 through at least 65535).

1-20.3.6.5.2 Functional Processing.- This function shall generate a header record on the output file. The header type shall be simulation, the scenario start time, the scenario stop time, and name shall be converted from the scenario specification and placed in the assigned places on the file. If necessary, the header record shall be filled with zeros to equal the length of the recording tape header record. All unused fields shall be filled with zeros.

For each message specification, a message record shall be generated at the message start time specified, and thereafter at the repetition rate specified, until the message stop time is exceeded. If the scenario stop time is less than the scenario start time, the scenario includes midnight. In this case, at a simulated time of midnight (2400 hours), the time shall be decremented by 24 hours. Also, the scenario shall not be stopped until after midnight occurs. If a message stop time is less than a message start time, the message generation period includes midnight. In this case, the message time shall be decremented by 24 hours at midnight. If no repetition rated is specified, the message shall be output once. If a cycle number is specified, the specified number shall be used for the first message and incremented for each succeeding instance of that message.

Each message record shall contain a record ID denoting Service A or external message, the message image, the time of the message and the unique event number (which shall be zero if none is specified). All messages shall be placed on the output file in time order. The last message record shall contain a time equal to the scenario stop time.

1-20.3.6.5.3 External Outputs.- The external output consists of two files. One file is a simulation file (optionally a disk or tape file) containing a header record and message records. Each header record contains the following:

       Header type (simulation)
       Scenario start time
       Scenario stop time
       Scenario name

Each message record contains the following:

       Record ID (Service A or input message)
       Time of message
       Message image
       Unique event number

The last message record contains the stop time of the scenario.

The second file output contains a list of the scenario specification, with
any errors found. Each error shall be associated with the individual
header or message specification to which it pertains by being placed
immediately after the individual specification to which it refers. A count
of the number of errors shall be output at the end of the file in the form
"nn ERRORS" when nn are numerals or "NO ERRORS".

1-20.3.6.5.4 Error Processing.- The following error cheeks shall be
performed on the header specification, and the specified error message
shall be output to the error file:

       More than 12 characters in the name: NAME TOO LARGE.
       Start time with hours greater than 23, minutes or seconds greater
       than 59, or non-numeric characters, or number of characters unequal
       to 6:INVALID START TIME.
       Stop time with same discrepancies as start time:INVALID STOP TIME.

Any error detected in the header shall cause output of the scenario file to
cease, but the input file shall be processed for further errors.

The following error checks shall be performed on each message specification
and the specified error message shall be output to the error file:

       Sensor address too large to fit in output message: SENSOR ADDRESS
       TOO LARGE. (Inhibits this message from being placed on simulation
       file.)
       Start time has the same checks and error message as in the header.
       In addition, if the message start time does not lie between the
       header start and stop times (taking midnight into account). The
       following error message shall be generated: START TIME OUTSIDE
       SCENARIO LIMITS. (Either discrepancy inhibits the message from
       being placed in the simulation file.)

        Header type (simulation)
        Scenario start time
        Scenario stop time
        Scenario name

Each message record contains the following:

        Record ID (Service A or input message)
        Time of message
        Message image
        Unique event number

The last message record contains the stop time of the scenario.

The second file output contains a list of the scenario specification, with
any errors found. Each error shall be associated with the individual
header or message specification to which it pertains by being placed
immediately after the individual specification to which it refers. A count
of the number of errors shall be output at the end of the file in the form
"nn ERRORS" when nn are numerals or "NO ERRORS".

1-20.3.6.5.4 Error Processing.- The following error cheeks shall be
performed on the header specification, and the specified error message
shall be output to the error file:

        More than 12 characters in the name: NAME TOO LARGE.
        Start time with hours greater than 23, minutes or seconds greater
        than 59, or non-numeric characters, or number of characters unequal
        to 6:INVALID START TIME.
        Stop time with same discrepancies as start time:INVALID STOP TIME.

Any error detected in the header shall cause output of the scenario file to
cease, but the input file shall be processed for further errors.

The following error checks shall be performed on each message specification
and the specified error message shall be output to the error file:

        Sensor address too large to fit in output message: SENSOR ADDRESS
        TOO LARGE. (Inhibits this message from being placed on simulation
        file.)
        Start time has the same checks and error message as in the header.
        In addition, if the message start time does not lie between the
        header start and stop times (taking midnight into account). The
        following error message shall be generated: START TIME OUTSIDE
        SCENARIO LIMITS. (Either discrepancy inhibits the message from
        being placed in the simulation file.)

1-20.3.6.6.3 External Outputs

      Data Base Snapshot Record

1-20.3.6.6.4 Error Processing.- If switching of tapes occur in the middle of a record, the entire data base snapshot shall be used as the **inital** data base snapshot for that tape. Switching of recording units. and processing of unavailable units shall be handled precisely as specified in data recording (see Section **1-20.3.6.6).** If part of the data base cannot be accessed, the inaccessible data shall be identified unambiguously within the record.

1-20.3.6.6.5 Quality Assurance **Provisions.-** The acceptance testing shall demonstrate that a record system state **command** is accepted and causes all appropriate data to be placed on the recording file. It shall be demonstrated that inaccessible parts of the data base shall be identified within the system state record. These tests shall be verified by printing of the system state records by system utilities. Switching of recording units and processing of unavailable units shall be demonstrated as specified in data recording (see Section **1-20.3.6.7).**

1-20.3.6.7 Function 4 - Data Recording

1-20.3.6.7.1 External **Inputs.-** This function shall accept recording specifications and recording execution requests. The recording specifications shall consist of the following:

      Location and name of data to be recorded.
      Amount of data to be recorded.
      Component triggering recording (if any).
      Whether recording is triggered at component initiation or
      termination (if triggered by component).
      Unique recording identifier for recording which is not triggered by
      component.
      Recording active/inactive designator.
      Recording message class (see Section **1-20.3.8.5).**

The recording execution request shall consist of the following:

      Name of component triggering recording.
      Unique recording identifier or indicator of component initiation or
      termination.

This function shall also accept switch recording unit **command:>SR,[SAME]**

1-20.3.6.7.2 Functional **Processing.-** A user with level 2 access shall be able to create, delete, and modify recording specifications using a data edit command. A user with level 1 access shall be able to display recording specifications, and to modify the specification so as to make it active or inactive. The user creating or modifying a recording specification shall be able to specify that the recording take place on initiation of a specific program component or on termination of a specific program component, where an activity/process **scheduled/dispatched** by the operating system may be made up of more than one program component. The user creating or modifying a recording specification shall also be able to give it a unique identifier, that shall cause the recording to take place on invocation of that identifier by the recording execution request.

Recording or all messages required for event reconstruction shall be effected by creating the necessary recording specifications with unique identifiers and associated recording execution requests.

On receiving a recording execution request with a unique recording identifier, this function shall generate and output a recording record containing the unique record ID, unless data recording has been eliminated as part of the reduced capability procedures. If the recording execution request is due to component initiation or component termination, all active recording specifications for **intiation** or termination, all active recording specifications for **intiation** or termination of that component shall be processed. That is, the component initiation or component termination ID, the time, record count, component name, name of data recorded and the data shall be placed on the record. If the recording execution request is identified by the unique recording identifier in the specification as being for recording a message, the recording specification shall be processed. That is, the recording ID (specifying the message class), the time, the record count, the unique event number (assigned to the message by the system), the logical address (of the device to which the message is sent or from which it is received), and the message image shall be recorded. If the recording execution request is identified by the unique recording identifier in the specification as being for recording a system event, the recording specification shall be processed. That is, the **message** recording ID (specifying a system event), the time, the record count, a unique system event number and the system event message received with the recording execution request shall be recorded. The system event number shall be a number from 0 to at least **65535,** assigned sequentially by the recording function.

When the data disk is filled with recording data, recording shall be switched to the system disk while the data disk is flushed to the tape unit. When the tape is filled, an end of the file shall be written on the

filled tape and it shall be rewound and an alert indicator (T) shall be
displayed at the CPS operators console. A header record with header type
of recording and the time shall be recorded as the first record on the
tape. The system state (as specified in Manually Initiated Recording of
System State 1-20.3.6.6) shall be recorded as the second record on the
tape. The system state shall also be recorded at regular intervals
(adaptation data) after the system state is recorded at the start of a new
tape.

If data recording is eliminated due to reduced capability procedures, a
system event shall be logged, and all recording records shall be output.
Any further (as well as previous) capability reductions shall also be
logged as system events.

On receipt of a switch recording tapes command (>SA), this function shall
output all outstanding records to the present tape, with an end of file
marker, and switch to the alternate recording tape unit (future
capability). If the same option is used (SA, SAME), the function shall not
switch to the alternate tape, but shall spool data until a new tape has
been mounted on the present unit and shall record the spooled data as
described above.

1-20.3.6.7 External Outputs

Alert to CPS operators console that a tape has been filled and
should be replaced:TAPE FULL.
System state records on the recording tape as described in
Section 1-20.3.6.5.
System event records containing:

- record ID
- data/time
- record count
- unique system event number
- system event

Header records containing

- header type (recording)
- header date/time

Message records containing:

- record ID
- date/time

filled tape and it shall be rewound and an alert indicator (T) shall be
displayed at the CPS operators console. A header record with header type
of recording and the time shall be recorded as the first record on the
tape. The system state (as specified in Manually Initiated Recording of
System State 1-20.3.6.6) shall be recorded as the second record on the
tape. The system state shall also be recorded at regular intervals
(adaptation data) after the system state is recorded at the start of a new
tape.

If data recording is eliminated due to reduced capability procedures, a
system event shall be logged, and all recording records shall be output.
Any further (as well as previous) capability reductions shall also be
logged as system events.

On receipt of a switch recording tapes command (>SA), this function shall
output all outstanding records to the present tape, with an end of file
marker, and switch to the alternate recording tape unit (future
capability). If the same option is used (SA, SAME), the function shall not
switch to the alternate tape, but shall spool data until a new tape has
been mounted on the present unit and shall record the spooled data as
described above.

1-20.3.6.7 External Outputs

   Alert to CPS operators console that a tape has been filled and
   should be replaced:TAPE FULL.
   System state records on the recording tape as described in
   Section 1-20.3.6.5.
   System event records containing:

      - record ID
      - data/time
      - record count
      - unique system event number
      - system event

   Header records containing

      - header type (recording)
      - header date/time

   Message records containing:

      - record ID
      - date/time

If there is no more room available on the system disk, the last record shall be a system event record with the message:

LOST DATA DUE TO STORAGE OVERFLOW

an audible alarm shall be sounded at the CPS operators console and the following alert shall be output:

RECORDING DATA LOSS DUE TO UNAVAILABLE TAPE

If the tape unit becomes unavailable while being used, recording shall be switched to the data and system disk and an audible alarm and alert shall be output to the CPS operator console:

TAPE UNIT NOT AVAILABLE

1-20.3.6.7.5 Quality Assurance **Provisions.-** The acceptance testing shall demonstrate that messages are recorded from each address associated with each class of message. (Reconstruction from these messages shall be demonstrated in DU 10). Recording of component initiation and component termination recording and of system event recording shall be demonstrated. Recording of system state records at the start of tapes and at time intervals shall be demonstrated. Inhibiting of a recording request and canceling of the inhibition shall be demonstrated.

Automatic and manual switching (with and without the same option) of a tape, shall be demonstrated together with the correct generation of alert messages.

Elimination of data recording for reduced capability operations and the logging of the system event on the recording tape and logging of subsequent system events shall be demonstrated.

Logging of unavailable data and lost data system events shall be demonstrated. All error alerts and alarms shall be demonstrated. Spooling and despooling of data via system backing storage shall be demonstrated.

1-20.3.7 Demonstrable Unit 5 — Critical Display Functions

1-20.3.7.1 Functional Capabilities Description.- This DU provides the capability of displaying all critical display data. All alerts and manual overrides at the critical display are provided. Assignment of runways to

specific positions in the cab and the **TRACON** is provided. Display of data
on all display surfaces is demonstrated. The specific functions to be
demonstrated are listed below:

        Display Time
        Display Barometric Pressure
        Display Center Field Wind
        Display **ATIS** Character
        Assign Runways   ,
        Configuration Control
        Display Assigned Runway Data
        Surface Wind Display
        Surface Observations **(SA)**
        Request Runway Visual Range Alarm

The time, barometric pressure, center field wind, **ATIS** character, and
surface observations shall be available at all times on all displays
containing critical data. All assigned runway data shall be available on
the backup critical display data page as well as on the critical and **TRACON**
displays to which it has been assigned by the assign runways or
configuration control commands. Boundary winds shall continuously be
displayed on the **TRACON** and backup critical data page displays and shall be
available in a dedicated space on the critical display by operator request
and when an alert condition occurs. **When** status data and surface
observation data change, the changed data shall be highlighted at each
critical, **TRACON,** and backup critical display page until acknowledged at
the individual display.

The format of the critical display is shown in Figure **1-20-3.** The format
of the backup critical display page is shown in Figure **1-20-4.** The data
fields from the first four lines of the **TRACON** display shall be identical
to the first four lines of the backup critical display page, with any
additional space displayable on the line added to the alarm fields.

1-20.3.7.2 System Components **Required.-** CPS, SMDs, critical display,
TRACON display, and supplementary display.

1-20.3.7.3 Other Demonstrable Units Required.- DU1, DU2, and **DU3.**

1-20.3.7.4 Function **1.-** Display Time.

1-20.3.7.4.1 External Inputs

        Coded Time Source **(if hardware** is available)
        Control Time Override from **SMD**
        Control Time **Re-enable** from **SMD**

specific positions in the cab and the TRACON is provided. Display of data
on all display surfaces is demonstrated. The specific functions to be
demonstrated are listed below:

> Display Time
> Display Barometric Pressure
> Display Center Field Wind
> Display ATIS Character
> Assign Runways
> Configuration Control
> Display Assigned Runway Data
> Surface Wind Display
> Surface Observations (SA)
> Request Runway Visual Range Alarm

The time, barometric pressure, center field wind, ATIS character, and
surface observations shall be available at all times on all displays
containing critical data. All assigned runway data shall be available on
the backup critical display data page as well as on the critical and TRACON
displays to which it has been assigned by the assign runways or
configuration control commands. Boundary winds shall continuously be
displayed on the TRACON and backup critical data page displays and shall be
available in a dedicated space on the critical display by operator request
and when an alert condition occurs. When status data and surface
observation data change, the changed data shall be highlighted at each
critical, TRACON, and backup critical display page until acknowledged at
the individual display.

The format of the critical display is shown in Figure 1-20-3. The format
of the backup critical display page is shown in Figure 1-20-4. The data
fields from the first four lines of the TRACON display shall be identical
to the first four lines of the backup critical display page, with any
additional space displayable on the line added to the alarm fields.

1-20.3.7.2 System Components **Required.-** CPS, SMDs, critical display,
TRACON display, and supplementary display.

1-20.3.7.3 Other Demonstrable Units Required.- DU1, DU2, and DU3.

1-20.3.7.4 Function **1.-** Display Time.

1-20.3.7.4.1 External Inputs

> Coded Time Source (if hardware is available)
> Control Time Override from SMD
> Control Time Re-enable from SMD

Line	Display
1	tttttbbbbwww/ww/ww a
2	rrrdmmmmmmmmmmmmvvvvTvvvvMvvvvRsx
3	rrrdmmmmmmmmmmmmvvvvTvvvvMvvvvRsx
4	rrrdmmmmmmmmmmmmvvvvTvvvvMvvvvRsx
5	•
6	•
7	•
8	•
9	•
10	•
11	•
12	rrrdmmmmmmmmmmmmvvvvTvvvvMvvvvRsx
13	ccfffggccfffggccfffgg
14	ccfffggccfffggccfffgg
15	SA--------------------------SA
16	SA--------------------------SA

Figure 1-20-4 Backup Critical Display Page Format

Line	Display
1	tttttbbbbwww/ww/ww a
2	rrrdmmmmmmmmmmmvvvvvTvvvvMvvvvRsx
3	rrrdmmmmmmmmmmmvvvvvTvvvvMvvvvRsx
4	rrrdmmmmmmmmmmmvvvvvTvvvvMvvvvRsx
5	•
6	•
7	•
8	•
9	•
10	•
11	•
12	rrrdmmmmmmmmmmmvvvvvTvvvvMvvvvRsx
13	ccfffggccfffggccfffgg
14	ccfffggccfffggccfffgg
15	SA---------------------------SA
16	SA---------------------------SA

Figure 1-2 0-4 Backup Critical Display Page Format

1-20.3.7.4.2 Functional **Processing**.- This function shall convert the time of day to hours, minutes, and seconds **modulo 24** hours in displayable characters.   If the Coded Time Source **(CTS)** is available and enabled, the time of day from the **CTS** shall be the source of the time of **day.** If the **CTS** is not available or is Overridden, an internal time of day driven from a **CPS** realtime clock **(RTC)** shall be the source of the time of day.

If a control time override is received from an **SMD,** the source for the time of day shall be switched to the **CPS RTC.** If there is a time in the override received from an **SMD,** the internal time of day shall be set from that time.   If a control time **re-enable** is received, the source for the time of day shall be switched to the **CTS.**

1-20.3.7.4.3 External Outputs

> Time of day in hours **(00** to **23),** minutes **(00** to **59),** and seconds **(00** to **59)**

1-20.3.7.4.4 Error **Processing**.- If there is a time in the time override from an **SMD,** it shall be checked for validity. The hours must be **between** 0 and **23** and the minutes and seconds must each be between 0 and **59.**   If these fields are not valid, the override shall be ignored and an error message "INVALID TIME **hhmmss**" where **hh** is hours, mm is minutes, and **ss** is **seconds,** shall be displayed on the inputting console.

1-20.3.7.4.5 Quality Assurance **Provisions**.- The acceptance testing **shall** demonstrate that the Coded Time Source is the source of the time of day unless overridden.   If a **CTS** is available, it shall be used as the source. If a **CTS** is not available, a time value shall be inserted in the data element in which the time from the **CTS** is normally stored, and display of this time on the display shall be observed.   The time shall be **overridden** to **235730,** and display and updating of this time shall be observed. Turnover of the clock at midnight shall be observed. The normal **(CTS)** source of the time shall **re-enable** and display of the **CTS** time or the inserted value shall be observed.   Rejection of invalid times **(240000, 01, 010160, 006000)** and acceptance of valid times **(235939, 000000, 95930)** shall be demonstrated.   At least one rejection and one acceptance shall be demonstrated while the normal and the internal time of day is being used as the source.   Display of data on the critical display and on the **TRACON** display as well as availability of the data on the backup critical display page at both the supplementary display and the **SMDs,** shall be verified.

1-20.3.7.5 Function 2 - Display Barometric Pressure

1-20.3.7.5.1 External Inputs

> Barometric Pressure (if hardware is available)
> Control Barometric Pressure override from **SMD**
> Control Barometric Pressure **re-enable** from **SMD**

1-20.3.7.5.2 Functional **Processing.-** This function shall convert the barometric pressure to hundredths of inches of mercury corrected to mean sea level in displayable characters. If the barometric pressure instrument is enabled, the barometric pressure from the barometric pressure instrument shall be the source of the display. If the barometric pressure is overridden, manually entered barometric pressure shall be displayed.

If a control barometric pressure override is received from an **SMD,** the source for the barometric pressure shall be switched to the manually entered barometric pressure.

A valid barometric pressure must be in the control altimeter setting override, then the barometric pressure shall be used for the altimeter setting.

If a control barometric pressure **re-enable** is received from an **SMD,** the source for the barometric pressure shall be switched to the barometric pressure sensor.

1-20.3.7.5.3 External **Outputs.-** Barometric pressure in hundredths of inches of mercury **(4** digits).

1-20.3.7.5.4 Error **Processing.-** If the barometric pressure in the control override from an **SMD** is not four numeric characters, the message shall be rejected, and 'INVALID ALTIMETER **nnnn'** where **nnnn** is the invalid parameter, shall be displayed at the entering **SMD.**

1-20.3.7.5.5 Quality Assurance **Provisions.-** The acceptance testing shall verify that the barometric pressure device is the source of the display unless overridden. The barometric pressure shall be overridden and display of this new setting shall be demonstrated. Rejection of barometric pressure fields with alphabetic characters in each position and with too few and too many characters shall be demonstrated. At least one acceptance and one rejection shall be demonstrated while the normal and the override source of the barometric pressure is being used as the source. Display of

data on the critical display and on the **TRACON** display as well as on the backup critical display page at both the supplementary display and the **SMDs,** shall be demonstrated.

1-20.3.7.6 Function 3 - Display Centerfield Wind

1-20.3.7.6.1 External Inputs

> Measured wind - consisting of centerfield wind speed, direction and gust speed from measuring device.
> Control centerfield wind override from **SMD**
> Control centerfield wind **re-enable** from **SMD**

1-20.3.7.6.2 Functional **Processing.-** This function shall convert the measured wind (wind speed, direction, and gust speed) to displayable characters in knots and degrees. If the wind measuring device is enabled, it shall be used as the source of the measured wind. If the wind measuring device is overridden, an alternate wind speed, direction, and (optionally) gust speed entered with the override shall be used as the source of the display if the gust speed is not included in the source of the wind (whether it is the wind measuring device or the override) blanks shall be displayed in the gust display area.

If an alternate wind speed, direction, and gust speed override is received from an **SMD,** the source of the wind data shall be switched to the manually entered wind data.

If valid centerfield wind data is included in the control centerfield wind override, the centerfield wind data shall be used for display.

If a control centerfield wind **re-enable** is received from an **SMD,** the source for the centerfield wind data shall be switched to the wind measuring device.

1-20.3.7.6.3 External Outputs

> Wind data in knots and degrees **(**5 or 7 digits)

1-20.3.7.6.4 Error Processing.- If the wind data in the control centerfield wind override from an **SMD** is not five or seven numeric characters, the message shall be rejected, and 'INVALID WIND **nnnnnn´** where **nnnnnn** is the invalid parameter, shall be displayed at the entering **SMD.**

data on the critical display and on the **TRACON** display as well as on the backup critical display page at both the supplementary display and the **SMDs,** shall be demonstrated.

1-20.3.7.6 Function 3 - Display Centerfield Wind

1-20.3.7.6.1 External Inputs

> Measured wind - consisting of centerfield wind speed, direction and gust speed from measuring device.
> Control centerfield wind override from **SMD**
> Control centerfield wind **re-enable** from **SMD**

1-20.3.7.6.2 Functional **Processing.-** This function shall convert the measured wind (wind speed, direction, and gust speed) to displayable characters in knots and degrees. If the wind measuring device is enabled, it shall be used as the source of the measured wind. If the wind measuring device is overridden, an alternate wind speed, direction, and (optionally) gust speed entered with the override shall be used as the source of the display if the gust speed is not included in the source of the wind (whether it is the wind measuring device or the override) blanks shall be displayed in the gust display area.

If an alternate wind speed, direction, and gust speed override is received from an **SMD,** the source of the wind data shall be switched to the manually entered wind data.

If valid centerfield wind data is included in the control centerfield wind override, the centerfield wind data shall be used for display.

If a control centerfield wind **re-enable** is received from an **SMD,** the source for the centerfield wind data shall be switched to the wind measuring device.

1-20.3.7.6.3 External Outputs

> Wind data in knots and degrees **(**5 or 7 digits)

1-20.3.7.6.4 Error Processing.- If the wind data in the control centerfield wind override from an **SMD** is not five or seven numeric characters, the message shall be rejected, and 'INVALID WIND **nnnnnn´** where **nnnnnn** is the invalid parameter, shall be displayed at the entering **SMD.**

1-20.3.7.8 Function 5 — Assign Runways

1-20.3.7.8.1 External Inputs

Assign Runway command from an **SMD** (**>** AR,r,p,1 where r is the runway name, p is the position designator and 1 is the line designator). Remove Runway from assignment command from an **SMD** (**>** AR,p,1 where p is the position designator and 1 is the line designator).

1-20.3.7.8.2 Functional Processing.- In response to a valid assign runway command (**>** AR) this function shall cause the runway name and the assigned runway data and alarms to be displayed on the designated **TRACON** or critical display position at the designated line, by the Display Assigned Runway Data function described below. Any data and alarms previously displayed on that line and any alarm data for that runway displayed on the alarm overflow line shall be erased. The runway name shall be displayed on the light control button corresponding to the selected line of the critical display.

The position designator specifies a **TRACON** display or a critical display and its associated light controls and supplementary display (if any). The position designators shall be names inserted as part of the adaptation data.

If the runway being assigned causes a runway to be removed from all assignments in the CAB or the **TRACON,** that runway shall be removed from the CAB or the **TRACON** backup critical display page.

In response to a valid remove runway from assignment command, this function shall cause the runway name and all data and alarms, including alarms displayed on the alarm overflow line, to be erased from the designated line of the designated critical or **TRACON** display and from the light control button corresponding to the designated line of the critical display. If this runway is not assigned to any other critical or **TRACON** display, it shall be removed from the critical or **TRACON** backup supplementary display page.

1-20.3.7.8.3 External Outputs

Erasing of runway names, data, and alarms to the display.
Runway assignments to the Display Assigned Runway Data Function.

1-20.3.7.8.4 Error Processing.- If the line selected is not 1, 2, or 3 or if the runway specified is not an existing runway at this airport, or if

1-20.3.7.8 Function 5 - Assign Runways

1-20.3.7.8.1 External Inputs

> Assign Runway command from an **SMD** (**>** AR,**r,p,**1 where r is the runway
> name, p is the position designator and 1 is the line designator).
> Remove Runway from assignment command from an **SMD** (**>** AR,**p,**1 where
> p is the position designator and 1 is the line designator).

1-20.3.7.8.2 Functional **Processing.-** In response to a valid assign runway
command (**>** AR) this function shall cause the runway name and the assigned
runway data and alarms to be displayed on the designated **TRACON** or critical
display position at the designated line, by the Display Assigned Runway
Data function described below. Any data and alarms previously displayed on
that line and any alarm data for that runway displayed on the alarm
overflow line shall be erased. The runway name shall be displayed on the
light control button corresponding to the selected line of the critical
display.

The position designator specifies a **TRACON** display or a critical display
and its associated light controls and supplementary display (if any). The
position designators shall be names inserted as part of the adaptation
data.

If the runway being assigned causes a runway to be removed from all
assignments in the CAB or the **TRACON,** that runway shall be removed from the
CAB or the **TRACON** backup critical display page.

In response to a valid remove runway from assignment command, this function
shall cause the runway name and all data and alarms, including alarms
displayed on the alarm overflow line, to be erased from the designated line
of the designated critical or **TRACON** display and from the light control
button corresponding to the designated line of the critical display. If
this runway is not assigned to any other critical or **TRACON** display, it
shall be removed from the critical or **TRACON** backup supplementary display
page.

1-20.3.7.8.3 External **Outputs**

> Erasing of runway names, data, and alarms to the display.
> Runway assignments to the Display Assigned Runway Data Function.

1-20.3.7.8.4 Error Processing.- If the line selected is not **1, 2,** or 3 or
if the runway specified is not an existing runway at this airport, or if

1-20.3.7.9.1 External Inputs

>   Configuration Control Command
      (**> CR,x** where x is the label of the desired configuration)

1-20.3.7.9.2 Functional Processing.- In response to a valid configuration
control command, this function shall delete the runway names and assigned
runway data and alarms, including any alarm overflows, from each critical
display and light control or from each **TRACON** display and from each CAB or
TRACON backup critical display page. Each runway assignment specified for
the new configuration shall be processed as described in the assign runways
function (above).

1-20.3.7.9.3 External **Outputs.-** Same as assign runways functions.

1-20.3.7.9.4 Error Processing.- The error processing of the individual
assignments will be identical to that described for the Assign Runways
function. If a non-existent configuration is specified in a Configuration
Control Command, the **command** shall be rejected and

>   'INVALID **CONF CONT nnn'** where **nnn** is the invalid parameter, shall be
      displayed at the entering **SMD.**

1-20.3.7.9.5 Quality Assurance **Provisions.-** The same quality assurance
provisions that are demonstrated for the Assign Runway Command of the
assign runways function shall be **demonstrated** for the configuration control
command.

In addition, erasing of critical and **TRACON** runway data areas and runway
names on the light control shall be **demonstrated** for assignments which were
made by Assign Runway command and by Configuration Control command.
Rejection of non-existent configurations and output of the correct error
message shall be demonstrated.

1-20.3.7.10 Function 7 - Display Assigned Runway Data

1-20.3.7.10.1 External Inputs

>   Runway Assignments from the Assign Runways and Configuration Control
      functions including runway name, **TRACON/CAB** position, display line
      and light control.

Vortex Advisory System (VAS) separation distances.
Runway Visual Ranges (RVRs) and supplementary data characters.

If the RVR is a 500 series system, the data is received as a 32-bit serial
message. The display provides the controller with four numeric readings
and an additional character that denotes increasing (I), decreasing (D), or
no change in RVR reading (0). The next to last displayed character may be
a zero representing the units digit of the RVR, or the RVR system status:

    A = changing baseline
    b = performing background check
    C = full time shelf check
    F = failure detected by self check

If the RVR is a 400 series system, the self check and base line changing
features are not designed into the system. The data is received as a
12-bit serial message. The display provides the controller with two
numeric readings and an additional character that denotes the following:

    + = Visibility greater than 60
    +T = Implied visibility greater than 60 in the test mode
    T = Test Mode
    -T = Display of 10-T (implied)
    L = Light setting data missing

    ILS status for:
    Glide slope
    Localizer
    Inner Marker
    Middle Marker
    Outer Marker
    Far Field Monitor

    Backup ILS - same as ILS (above).
    Approach Light System (ALS) status and lighting intensity.
    Approach Light System (MALS) status and lighting intensity.
    Sequence Flasher Lights (SFL) status.

1-20.3.7.10.2 Functional Processing.- This function shall display at the
specified (by assignment via the assign runway or configuration control
function) line of the TRACON or CAB display and at the light control button
and on the backup critical display the runway name. If the name is less
than three characters, it shall be left justified.

Vortex Advisory System **(VAS)** separation distances.
Runway Visual Ranges **(RVRs)** and supplementary data characters.

If the **RVR** is a **500** series system, the data is received as a **32-bit** serial message. The display provides the controller with four numeric readings and an additional character that denotes increasing (I), decreasing **(D),** or no change in **RVR** reading **(0).** The next to last **displayed character** may be a zero representing the units digit of the **RVR,** or the **RVR** system status:

> A = changing baseline
> **b** = performing background check
> C = full **time** shelf check
> **F** = failure detected by self check

If the **RVR** is a **400** series system, the self check and base line changing features are not designed into the system. The data is received as a **12-bit** serial message. The display provides the controller with two numeric readings and an additional character that denotes the following:

> **+** = Visibility greater than **60**
> **+T** = Implied visibility greater than **60** in the test mode
> T = Test Mode
> **-T** = Display of **10-T** (implied)
> L = Light setting data missing
>
> **ILS** status for:
> Glide slope
> **Localizer**
> Inner Marker
> Middle Marker
> Outer Marker
> Far Field Monitor
>
> Backup **ILS** - same as **ILS** (above).
> Approach Light System **(ALS)** status and lighting intensity.
> Approach Light System **(MALS)** status and lighting intensity.
> Sequence Flasher Lights **(SFL)** status.

1-20.3.7.10.2 Functional Processing.- This function shall display at the specified (by assignment via the assign runway or configuration control function) line of the **TRACON** or CAB display and at the light control button and on the backup critical display the runway name. If the name is less than three characters, it shall be left justified.

This function shall display the runway edge lighting intensity (3, 4, or 5) preceded by an S. If no current intensity is available, an S followed by a blank shall be displayed. This character shall be highlighted when changed until acknowledged at ea h individual position.

If an alert is received ndicating that equipment associated with a runway is down, the following a arms shall be displayed for that runway:

        ILS: GS - Glide Slope
             LOC - Localizer
             IM - Inner Marker
             MM - Middle Marker
             OM - Outer Marker
             FF - Far Field Monitor

        Backup ILS: BGS - Glide Slope
        in Cat. III BLOC - Backup Localizer
        operation)   BIM - Backup Inner Marker
                     BMM - Backup Middle Marker
                     BOM - Backup Outer Marker
                     BFF - Backup Far Field Monitor

        ALS: ALS
        MALS: MAL

The alarm shall be highlighted at the TD, CD, and backup critical display data page, and an audible alarm shall be sounded at each TRACON and CAB display assigned this runway until the alert is acknowledge at the individual TRACON or tower cab display. The alarm shall then be displayed normally as long as the alert condition continues. If there is insufficient room for an alarm in the display area for a specific runway on the critical display, a continuation indicator shall be displayed in the first empty space in the runway alarm area and an identical continuation indicator shall be displayed in che alarm overflow area, on the line immediately below the last runway data line. If there is no blank space in the runway alarm area for a continuation character, the rightmost alarm indicator in the alarm area shall be deleted from the runway alarm area and placed in the overflow area immediately following the appropriate continuation indicator. If deleting the rightmost alarm indicator provides enough display area for the new alarm indicator and the continuation indicator to be displayed in the runway alarm area, this shall be done. If the new alarm indicator is not added to the runway alarm area, it shall be added to the alarm overflow area immediately after any alarm indicators for

this runway, or after the continuation indicator if there are no alarm
indicators. The alarm continuation for the first runway (from the top of
the display) displays shall be a rectangle (▯) displayed to the left of the
alarm continuation for the other runways. The alarm continuation for the
second runway (from the top of the display) shall be a small right triangle
(◢) displayed to the left of the alarm continuation for the third runway
which shall be isoceles triangle (A). All the alarms shall be left
justified.

When the alarm condition ends, the alarm shall be deleted from the **TRACON,**
critical and backup critical displays whether it has been acknowledged or
not and the audible alarms shall be shut off. The remaining alarms in the
affected runway alarm area and alarm overflow area shall be left justified
within the areas. If an alarm is deleted from a runway alarm area which
has a continuation in the overflow area, the leftmost alarm in the alarm
overflow area shall be placed in the runway alarm area, left justified to
the right of any alarm in the area, if there is room. If this is the only
alarm for this runway in the alarm overflow area, the continuation
indicators shall be deleted and any **overflow alarms** from other runways
shall be left justified.

1-20.3.7.10.3 External Outputs

> Runway names to **TRACON,** critical and backup critical display pages
> and to light controls.
> **VAS** separation distances.
> **RVR** values and supplementary data character suffix.
> **ALS/MALS** lighting intensity prefixed by **"S".**
> Alarms for **ILS,** backup **ILS, SFL,** and **ALS/MALS** as specified under
> functional processing.

1-20.3.7.10.4 Error **Processing.-** If a runway name which lacks associated
data elements is assigned, blanks shall be displayed in the appropriate
fields. If the data element for any alarm is not defined, that alarm is
not displayed. If the total number of characters in the alarm overflow
field of the critical display, or in any runway alarm field of the **TRACON**
or backup critical display exceed the size of the display area, they will
not be displayed. To indicate this condition on the critical display, the
runway name of all affected runways shall be highlighted. To indicate this
condition on the **TRACON** and backup critical display, the runway name of the
affected runways shall be highlighted.

1-20.3.7.10.5 Quality Assurance **Provisions.-** Unless specified otherwise, all display demonstrations shall be performed on TRACON, critical, and backup critical display data page displays.

Corrected display of runway names, data, and alarms for runways assigned via both the assign runway and configuration control command, shall be demonstrated on the same page of the TRACON display and on the critical display. Display of all assigned runways on the backup critical display data shall be demonstrated. Display of names with two and three characters shall be demonstrated.

Display of expected VAS values shall be demonstrated, with highlighting on change and removal of highlighting on acknowledgment at individual positions.

Display of expected RVR values and all statuses from both 400 series and 500 series RVRs shall be demonstrated, with highlighting on change of each character and removal of highlighting on acknowledgment at the individual position. Correct display of all possible values of each character position (including leading blanks) and highlighting due to a change in each individual character shall be demonstrated.

Display of all expected runway edge light intensities (3 through 5) shall be demonstrated, with highlighting on change of each character and removal of highlighting on acknowledgment at the individual position.

Correct display of each alarm shall be demonstrated, with highlighting when first displayed and removal of highlighting after acknowledgment at the individual position. Sounding and stopping of the audible alarm shall also be demonstrated. Display of continuation symbology for all lines on the critical display shall be demonstrated. Moving of a smaller alarm symbol to the line containing the runway name when there is not room on that line for a continuation symbol as well as displaying a same size or larger symbol on the overflow line immediately after the moved symbol shall be demonstrated. Placing of continuation on the overflow line in the correct sequence, for all time sequences of the overflows shall be demonstrated. Highlighting of the runway names of all three lines due to overflow of alarms from the continuation area shall be demonstrated. Correct closing up of blanks after removal of alarms (both acknowledged and unacknowledged) and stopping the audible alarm after the removal of the last alarm shall be demonstrated. Deletion of continuation symbology, after the deletion of the alarm overflow and removal of highlighting of the runway names after the end of the continuation line overflow shall be demonstrated.

1-20.3.7.10.5 Quality Assurance **Provisions.**- Unless specified otherwise, all display demonstrations shall be performed on TRACON, critical, and backup critical display data page displays.

Corrected display of runway names, data, and alarms for runways assigned via both the assign runway and configuration control command, shall be demonstrated on the same page of the TRACON display and on the critical display. Display of all assigned runways on the backup critical display data shall be demonstrated. Display of names with two and three characters shall be **demonstrated.**

Display of expected VAS values shall be demonstrated, with highlighting on change and removal of highlighting on acknowledgment at individual positions.

Display of expected RVR values and all statuses from both 400 series and 500 series RVRs shall be demonstrated, with highlighting on change of each character and removal of highlighting on acknowledgment at the individual position. Correct display of all possible values of each character position (including leading blanks) and highlighting due to a change in each individual character shall be demonstrated.

Display of all expected runway edge light intensities (3 through 5) shall be demonstrated, with highlighting on change of each character and removal of highlighting on acknowledgment at the individual position.

Correct display of each alarm shall be demonstrated, with highlighting when first displayed and removal of highlighting after acknowledgment at the individual position. Sounding and stopping of the audible alarm shall also be demonstrated. Display of continuation symbology for all lines on the critical display shall be demonstrated. Moving of a smaller alarm symbol to the line containing the runway name when there is not room on that line for a continuation symbol as well as displaying a same size or larger symbol on the overflow line immediately after the moved symbol shall be demonstrated. Placing of continuation on the overflow line in the correct sequence, for all time sequences of the overflows shall be demonstrated. Highlighting of the runway names of all three lines due to overflow of alarms from the continuation area shall be **demonstrated.** Correct closing up of blanks after removal of alarms (both acknowledged and unacknowledged) and stopping the audible alarm after the removal of the last alarm shall be demonstrated. Deletion of continuation symbology, after the deletion of the alarm overflow and removal of highlighting of the runway names after the end of the continuation line overflow shall be demonstrated.

1-20.3.7.11.4 Error Processing.- If a character is encountered in the wind direction or speed field is not displayable, a blank shall be displayed. If more than two characters are found in a LLWSAS boundary designator, the first two characters shall be displayed.

1-20.3.7.11.5 Quality Assurance Provisions.- Correct displays of one, two, and three character LLWSAS boundary designators shall be demonstrated. Correct display of wind direction and speed including every displayable digit in every position shall be demonstrated. Display of blanks for nondisplayable character in every position of the LLWSAS boundary designator and wind direction and speed shall be demonstrated. These demonstrations shall be verified for the critical and backup critical display page. Correct processing of characters which are displayable on the backup critical display page, but are not displayable on the critical display shall be demonstrated.

1-20.3.7.12 Function 9 - Surface Observations

1-20.3.7.12.1 External Inputs

> Data elements containing parsed surface observation (SA) message contents for this location from Service A processing function. Display data element edited by an SMD with level one access.

1-20.3.7.12.2 Functional Processing.- This function shall erase both lines of the critical display and backup critical display allocated to the SA message for this site when a new SA, RS, USP message arrives for the local facility.

The following fields shall be displayed in order, with trailing and leading blanks deleted:

> Origin
> Message type
> Time
> Sky condition (if present)
> Visibility (if present)
> Weather and obstruction to visibility (if present)
> Temperature (if present)
> Dew Point (if present)
> Remarks (if present)

There shall be one blank between each pair of fields. If more than one line is needed for display of the message, the first line of the message shall be broken at the blank nearest the end of the first line whether it's inside a field or separates two fields. The message shall be highlighted until acknowledged at the individual position.

An **SMD** user shall have the capability to enter text in either one or both of the lines of the critical display by editing the display data element, if he has level one access.

1-20.3.7.12.3 External Outputs

>   Surface observation data or **SMD** user entered override of message
>   area to display (highlighted if changed until acknowledged).

1-20.3.7.12.4 Error Processing.- If the display element contains too many characters to fit on the critical or the backup critical display page, the entire displayed element shall be output to the Service A editing console (see Section **1-20.3.10.19)** with the following indication "CRITICAL DISPLAY WEATHER TOO LONG' and the characters that occupy undisplayable positions shall be highlighted. Until the message is edited, the same indicator "CRITICAL DISPLAY WEATHER TOO LONG" shall be displayed on the critical display and backup critical display pages. If an undisplayable character is encountered on the display element, the entire display element shall be output to the Service A edit console with the **following** indicator: "UNDISPLAYABLE CHARACTER" and the undisplayable character position shall be highlighted. Until the message is edited, the indicator "UNDISPLAYABLE CHARACTER" shall be displayed on the critical display and backup critical display pages.

1-20.3.7.12.5 Quality Assurance **Provisions.-** The acceptance testing shall demonstrate that both lines of the display area erased, when the new message requires only a single line and shall demonstrate display of a two line message. Display of every field and of the minimum and maximum lengths (where appropriate) of variable length fields shall be demonstrated. Continuation of a message on the second line at a blank terminating a field and also at a blank embedded in a field shall be demonstrated. Highlighting of the new message on the critical and backup critical display pages until acknowledged shall be demonstrated.

Entering of a message into the display element by editing, and highlighting of the new message on the critical and backup critical display page until acknowledged shall be demonstrated.

There shall be one blank between each pair of fields. If more than one
line is needed for display of the message, the first line of the message
shall be broken at the blank nearest the end of the first line whether it's
inside a field or separates two fields. The message shall be highlighted
until acknowledged at the individual position.

An **SMD** user shall have the capability to enter text in either one or both
of the lines of the critical display by editing the display data element,
if he has level one access.

1-20.3.7.12.3 External Outputs

Surface observation data or **SMD** user entered override of message
area to display (highlighted if changed until acknowledged).

1-20.3.7.12.4 Error Processing.-
If the display element contains too many
characters to fit on the critical or the backup critical display page, the
entire displayed element shall be output to the Service A editing console
(see Section **1-20.3.10.19)** with the **following** indication "CRITICAL DISPLAY
WEATHER TOO LONG" and the characters that occupy undisplayable positions
shall be highlighted. Until the message is edited, the same indicator
"CRITICAL DISPLAY WEATHER TOO LONG" shall be displayed on the critical
display and backup critical display pages. If an undisplayable character
is encountered on the display element, the entire display element shall be
output to the Service A edit console with the **following** indicator:
"UNDISPLAYABLE CHARACTER" and the undisplayable character position shall be
highlighted. Until the message is edited, the indicator "UNDISPLAYABLE
CHARACTER" shall be displayed on the critical display and backup critical
display pages.

1-20.3.7.12.5 Quality Assurance **Provisions.-**
The acceptance testing shall
demonstrate that both lines of the display area erased, when the new
message requires only a single line and shall demonstrate display of a two
line message. Display of every field and of the minimum and maximum
lengths (where appropriate) of variable length fields shall be
demonstrated. Continuation of a message on the second line at a blank
terminating a field and also at a blank embedded in a field shall be
demonstrated. Highlighting of the new message on the critical and backup
critical display pages until acknowledged shall be demonstrated.

Entering of a message into the display element by editing, and highlighting
of the new message on the critical and backup critical display page until
acknowledged shall be demonstrated.

These lists fully describe the necessary input message conversion. The first describes the general format of all input messages and the particular format to be used in decoding each message type. The second provides special user defined look up tables for specialized input conversion. The third indicates the attributes and destinations of all messages on a device by device basis.

1-20.3.8.3.1 Procedure 1 - Message Format Definition.- This procedure describes the definition of input message formats.

1-20.3.8.3.1.1 External Inputs.- The user shall enter data into, or modify the format definition list via the Modify List (ML) command. The format definitions shall be **stored in SYS:LIST_OF_INPUT** FORMATS. The first line in their list shall define the general **format** of-all input messages. Their format shall be defined in terms of fields. Keywords are positional and may occur more than once. Three mandatory field type keywords shall be defined, these are **DEV, MSGID,** and COUNT; two optional field type keywords are also defined, these are NULL and STRIP. The value of **DEV** indicates the number of characters in the Device Address. **MSGID** indicates the number of characters in the Message Format Identifier field. COUNT indicates the number of characters in the text length count field. NULL indicates the length of a fixed length undefined field which is to be passed through the input decoding process **undecoded** and STRIP indicates the length of an undefined field which is to be stripped off (e.g., **protocal** data).

An example might be:

> LINE **1,** STRIP = **6, DEV = 2, MSGID = 2,** COUNT **= 2,** NULL = **1,**
> STRIP = 6

where 'LINE **1′** is a dummy format identifier. This specification says that all input messages shall consist of:

> 6 characters to be **STRIPped**
> 2 device address characters
> 2 message format identifier characters
> 2 text length COUNT characters
> COUNT characters, i.e., number of message text characters
> 1 NULL character
> 6 characters to be **STRIPped**

Subsequent lines of the list shall define individual messages. The format shall be:

```
msg identifier, (conversion type, field length, [LOOKUP = table]),
                [(conversion type, field length, [LOOKUP = table]),
                .... [conversion type, field length,
                [LOOKUP = table])
```

where **'msg** identifier' shall be the unique name identifying the format, the
length of this parameter shall equal the value of **MSGID** as defined on
LINE 1.

The second (through **nth)** fields shall define the conversion to be carried
out and the number of characters in the input field. Valid conversion
types shall be:

      Ø - NULL, field is to be skipped
      1 - ASCII, transparent (no conversion)
      2 - **BCD,** converted to ASCII
      3 - EBCDIC, converted to ASCII
      4 - Unsigned Integer, converted to ASCII representation of decimal
      5 - Two's complement, converted to ASCII representation of decimal
      6 - Table Look up, input converted according to user supplied
         LOOKUP table.

The optional parameter LOOKUP shall be valid only for type **6,** its value
shall be the last qualifier name of the user created Look Up Table List
(see Section **1-20.3.8.3.2).**

1-20.3.8.3.1.2 Functional Processing.- Error checking defined below.

1-20.3.8.3.1.3 External **Outputs.-** The updated message format list shall be
written out to permanent storage.

1-20.3.8.3.1.4 Error **Processing.-** The following error checks shall be
made: When a new format is defined with a LOOKUP parameter, that table
name shall be checked against the list of user defined look up tables. If
no match is found, the message:

      LOOK UP TABLE table name IS NOT DEFINED, INPUT SUPPRESSED

shall be displayed and the **command** aborted.

When a format is deleted, its **'msg** identifier' shall be checked against the
Device Message Attribute Definition list to see if the format is still
required. If it is, **the message:**

```
msg identifier, (conversion type, field length, [LOOKUP = table]),
                [(conversion type, field length, [LOOKUP = table]),
                .... [conversion type, field length,
                [LOOKUP = table])
```

where **'msg** identifier' shall be the unique name identifying the format, the
length of this parameter shall equal the value of **MSGID** as defined on
LINE **1.**

The second (through **nth)** fields shall define the conversion to be carried
out and the number of characters in the input field. Valid conversion
types shall be:

> **∅ −** NULL, field is to be skipped
> 1 − ASCII, transparent (no conversion)
> 2 − **BCD,** converted to ASCII
> 3 − EBCDIC, converted to ASCII
> 4 − Unsigned Integer, converted to ASCII representation of decimal
> **5 −** Two's complement, converted to ASCII representation of decimal
> 6 − Table Look up, input converted according to user supplied
>   LOOKUP table.

The optional parameter LOOKUP shall be valid only for type **6,** its value
shall be the last qualifier name of the user created Look Up Table List
(see Section **1-20.3.8.3.2).**

1-20.3.8.3.1.2 Functional Processing.- Error checking defined below.

1-20.3.8.3.1.3 External **Outputs.−** The updated message format list shall be
written out to permanent storage.

1-20.3.8.3.1.4 Error **Processing.−** The following error checks shall be
made: When a new format is defined with a LOOKUP parameter, that table
name shall be checked against the list of user defined look up tables. If
no match is found, the message:

> LOOK UP TABLE table name IS NOT DEFINED, INPUT SUPPRESSED

shall be displayed and the **command** aborted.

When a format is deleted, its **'msg** identifier' shall be checked against the
Device Message Attribute Definition list to see if the format is still
required. If it is, **the message:**

1-20.3.8.3.3 Procedure 3 - Device Message Attribute Definition.- This
procedure describes the definition of device specific message attributes
and destinations.

1-20.3.8.3.3.1 External Inputs.- The user shall enter data into, or modify
the Device Message Attribute list via the Modify List (ML) command. This
list shall be called **SYS:DEVICE-MESSAGE-ATTRIBUTES** and shall be in the
form:

        device address, (data element **1,** [length = characters]),
                        [(data element **2,** [length = characters],
                        . . . . (data element **n],**
                        [PRIORITY = level], [CALL = name]

where 'device address' is the free formal device address or name as
specified in the **DEV** field of the input message. One or more Data Element
names shall be specified, these shall be the destination data elements of
decoded data fields described by the message format definition names in the
input **MSGID** field. If fewer data elements are specified in this list than
in the message format, only the number defined in this list shall be
decoded; if more are specified in this list, only the number specified in
the message format shall be decoded.

The keyword LENGTH allows the user to specify the length of the output
field to be stored in the Data Base. If specified, this value shall
override the SIZE specified in the Data Base definitions.

The **keywork** PRIORITY shall be a positive integer and shall represent the
dispatching priority for decoded messages. All decoded messages are placed
on a queue for further processing and insertion in the data base. This
processing shall take place on a priority basis with higher numeric
priority processed first. Within a given priority, processing shall be on
a FIFO basis.

The keyword CALL designates the name of an optional software module to be
invoked to process the message received from 'device address'.

1-20.3.8.3.3.2 Functional **Processing.-** Error checking defined below.

1-20.3.8.3.3.3 External Outputs.- The updated list of Device Message
Attributes shall be written out to permanent storage.

1-20.3.8.3.3.4 Error **Processing.-** The following error checks shall be
performed: All Data Element names shall be checked against the Member

definition lists. If a Data Element has not been defined, the message:

> data element IS NOT A DEFINED DATA ELEMENT NAME, INPUT SUPPRESSED

shall be displayed and the command aborted.

If the CALL keyword specifies an undefined software module, the message:

> name IS NOT A DEFINED SOFTWARE MODULE, INPUT SUPPRESSED

shall be displayed and the command aborted.

1-20.3.8.3.3.5 Quality Assurance Provisions.- This procedure shall be verified by using the ML command to modify the device message attributes list, inserting and deleting device message attributes and destinations. All of the above error checks shall be exercised.

1-20.3.8.4 Function 2 - Input Message Conversion.- This function converts external input messages into Data Elements.

1-20.3.8.4.1 External Inputs.- Input messages received from external sources. These messages shall conform to a message format definable through the message format definition procedure described in Section **1-20.3.8.3** above. These messages may be from polled or interrupting devices.

1-20.3.8.4.2 Functional Processing.. Upon receipt of a message from an external input source, the message's MSGID field shall be examined and compared with the list of known messages. If the message is recognized and of the proper length, it shall be decoded using the format specified for MSGID in the Message Format List.

If special input processing is required (as specified by the CALL parameter), it shall be carried out at this time.

Data from the decoded message fields shall be dispatched to the appropriate Data Base Data Elements defined in the Device Message Attributes List. These data elements shall be dispatched on a priority basis as described in Section **1-20.3.8.3.3.**

The Data Base maintenance software shall perform input value replacement checking and perform Alarm and Alert functions as required by Section **1-20.3.5.**

definition lists.   If a Data Element has not been defined, the message:

        data element IS NOT A DEFINED DATA ELEMENT NAME, INPUT SUPPRESSED

shall be displayed and the command aborted.

If the CALL keyword specifies an undefined software module, the message:

        name IS NOT A DEFINED SOFTWARE MODULE, INPUT SUPPRESSED

shall be displayed and the command aborted.

1-20.3.8.3.3.5 Quality Assurance Provisions.- This procedure shall be
verified by using the ML command to modify the device message attributes
list, inserting and deleting device message attributes and destinations.
All of the above error checks shall be exercised.

1-20.3.8.4 Function 2 — Input Message Conversion.- This function converts
external input messages into Data Elements.

1-20.3.8.4.1 External Inputs.- Input messages received from external
sources.   These messages shall conform to a message format definable
through the message format definition procedure described in Section
1-20.3.8.3 above.   These messages may be from polled or interrupting
devices.

1-20.3.8.4.2 Functional Processing..   Upon receipt of a message from an
external input source, the message's MSGID field shall be examined and
compared with the list of known messages.   If the message is recognized and
of the proper length, it shall be decoded using the format specified for
MSGID in the Message Format List.

If special input processing is required (as specified by the CALL
parameter), it shall be carried out at this time.

Data from the decoded message fields shall be dispatched to the appropriate
Data Base Data Elements defined in the Device Message Attributes List.
These data elements shall be dispatched on a priority basis as described in
Section **1-20.3.8.3.3.**

The Data Base maintenance software shall perform input value replacement
checking and perform Alarm and Alert functions as required by Section
1-20.3.5.

EM - Event Message (record of computer system event)
PM - Positional Messages (from Critical, Supplementary, **LCP,** and
        TRACON positions)
CI - Component Initiation (triggered by initiation of program
        component)
CT - Component Termination (triggered by termination of program
        component)

Each message type may be assigned to a specific message handler. For
simulation and the purposes of this **DU,** only the **HD, IM,** and **SM** messages
need be defined. Specific message handler names shall be selected during
software development.

1-20.3.8.5.1.1 External Inputs.- The user shall input or modify data via
the Modify List (ML) command as described in Section **1-20.3.3.4.3.**

1-20.3.8.5.1.2 Functional Processing.- Special function software shall be
called to generate a new input tape message dispatch table. This table
shall designate the special purpose recording message handlers which shall
process a given message type.

1-20.3.8.5.1.3 External Outputs.- The updated input tape definition list
shall be written out to permanent storage.

1-20.3.8.5.1.4 Error Processing.- No specific error checks are required
for this procedure.

1-20.3.8.5.1.5 Quality Assurance Provisions.- This procedure shall be
verified by inputting valid and invalid message types and valid and invalid
handler names. Results will be checked by redisplaying the input page
list.

1-20.3.8.5.2 Procedure 2 - Simulation/Recording Tape Input **Processing.-**
Processing of the Simulation/Recording Tape shall be controlled from the
CPS operators console. A special executive program shall be initiated
which read the Simulation/Recording Tape replacing external device input
messages with messages from the tape.

1-20.3.8.5.2.1 External Inputs.- Two forms of external input shall be
required:

        Simulation/Recording Tape Input
        User Control Input

The Simulation/Recording file shall be read from disk or tape. A minimum configuration for simulation shall include a disk or tape drive for input and one for recording. A full capability simulation facility shall include two disk drives and one tape drive to allow continuous operation.

User control input shall be in standard control input format. The simulation executive shall prompt with the normal command prompt, but shall accept only the Initiate Simulation (IS), Halt Simulation (HS), Resume Simulation (RS), Next Event (NE), and End Simulation (ES) commands.

The syntax of these commands is as follows:

```
        IS, [Clock = clock rate], [EVENT]
            [HALTT = halt time], [HALTE = halt event]
        NE
        HS
        RS, [CLOCL = clock rate], [EVENT]
            [HALTT = halt time], [HALTE = halt event]
        ES
```

where 'clock rate' shall be the desired rate at which simulated inputs are to be dispatched. This shall be expressed as a decimal fraction where 1.0 shall equal real time. EVENT, if specified, shall indicate that input messages are to be read from the file and dispatched under operator control. If EVENT is specified, it shall override any specified 'clock rate'. Simulation shall be halted after the dispatch of the first message carrying a time stamp equal to or greater than 'halt time'. The format of 'halt time' shall be: hhmmssmmm

For example 134655.005 shall represent 13 hours, 46 minutes, 55.055 seconds GMT. The 'halt event' parameter shall specify that dispatch is to be halted after the message whose Unique Event Number (UEN) is equal to that specified by 'halt event'. If both parameters are specified, halting shall occur whenever either condition is satisfied.

The IS command shall initiate processing , processing shall continue until interrupted by a HALTE or HALTT condition or until an HS command is input. If EVENT was specified, only a single message shall be dispatched and input processing will be halted until an NE command is entered, this shall result in dispatch of the next message. Subsequent NE commands shall each dispatch one message.

If an HS command is entered, the processing of input messages shall be
halted.   If an RS is entered, processing shall resume.   The same optional
parameters may be specified for RS as for IS.   If no parameters are
specified, the parameters in effect for the previous IS or RS shall be
utilized.

An ES command shall terminate simulation processing and return the CPS
operator console to its normal status.

1-20.3.8.5.2.2 Functional Processing.-'For simulation purposes, only
external sensor messages (message type IM) and Service A weather messages
(message type SM) shall be processed.   Any other message found on the input
file shall be ignored.   External sensor messages shall be read from the
input file and dispatched to the input message processor.   Service A
message shall be dispatched to the Service A processor stub (the full
capability Service A processor shall be demonstrated in DU8).

Dispatch timing shall be performed as follows: Upon entry of the IS
command, a software clock, running at 'clock rate' shall be started.   The
input file header shall be read and the file start time determined. The
first message record shall then be read and its time tag decoded. When the
elapsed time on the software clock equals the time difference between the
file header time and the first message time, the first message shall be
dispatched.   Subsequent messages shall be dispatched when their elapsed
time from the header time is greater than or equal to the software clock
reading.   HS and RS commands shall, respectively, halt and restart the
software clock.

1-20.3.8.5.2.3 External Outputs.- Upon entry of an IS command, the program
will respond with the message:

        SIMULATION PROGRAM BEGUN
        WALL CLOCK TIME IS hhmmssZ
        INPUT FILE START TIME IS mmdd hhmmss

If the EVENT parameter was specified, the additional line:

        ENTER 'NE' TO STEP THROUGH EVENTS

shall be displayed.   When the program is halted by the HALTT time
parameter, the message:

If an HS command is entered, the processing of input messages shall be halted. If an RS is entered, processing shall resume. The same optional parameters may be specified for RS as for IS. If no parameters are specified, the parameters in effect for the previous IS or RS shall be utilized.

An ES command shall terminate simulation processing and return the CPS operator console to its normal status.

1-20.3.8.5.2.2 Functional Processing.-'For simulation purposes, only external sensor messages (message type IM) and Service A weather messages (message type SM) shall be processed. Any other message found on the input file shall be ignored. External sensor messages shall be read from the input file and dispatched to the input message processor. Service A message shall be dispatched to the Service A processor stub (the full capability Service A processor shall be demonstrated in DU8).

Dispatch timing shall be performed as follows: Upon entry of the IS command, a software clock, running at 'clock rate' shall be started. The input file header shall be read and the file start time determined. The first message record shall then be read and its time tag decoded. When the elapsed time on the software clock equals the time difference between the file header time and the first message time, the first message shall be dispatched. Subsequent messages shall be dispatched when their elapsed time from the header time is greater than or equal to the software clock reading. HS and RS commands shall, respectively, halt and restart the software clock.

1-20.3.8.5.2.3 External Outputs.- Upon entry of an IS command, the program will respond with the message:

        SIMULATION PROGRAM BEGUN
        WALL CLOCK TIME IS hhmmssZ
        INPUT FILE START TIME IS mmdd hhmmss

If the EVENT parameter was specified, the additional line:

        ENTER 'NE' TO STEP THROUGH EVENTS

shall be displayed. When the program is halted by the HALTT time parameter, the message:

1-20.3.8.5.2.5 Quality Assurance Provisions.- This Procedure shall be verified by processing a simulation tape generated under **DU4.** All error traps shall be exercised. The saturation condition shall be tested by gradually increasing the 'clock rate' parameter until the warning message occurs. Proper dispatch of messages shall be verified in the EVENT mode, comparing the tape dump obtained under **DU4** with the resultant displays. Service A dispatch shall be verified by checking printed output from the Service A processor stub. **HALTT** and **HALTE** halt modes shall be verified by comparing manual predictions of display output with **actuals.** The **HS** command shall be tested at a low clock rate where it can be verified that the halt is accepted immediately. The **RS** command shall be tested and parameter carryover and override shall be verified. ES termination and return to the operating system shall be observed.

1-20.3.9 Demonstrable Unit 7 **- FPU** Polling.- This **DU** describes the following function:

>   Definition of **FPU** Poll List
>   **FPU** poll generation
>   **Responde** checks

1-20.3.9.1 System Components Required.- **CPS, CPS** operator console, **FPU** communications interface, and **FPU** equipped test device.

1-20.3.9.2 Other Demonstrable Units Required.- **DU1, DU2, DU3, DU4,** and **DU6.**

1-20.3.9.3 Function 1 **-** Definition of **FPU** Poll List.- This function describes the definition of the **FPU** Poll List. The primary external input source to the **CPS** is the network of polled **FPUs.** The sequence and frequency of polling shall be determined by a user defined list.

1-20.3.9.3.1 External Inputs.- The user shall enter data into, or modify, the **FPU** Polling List via the Modify List (ML) command. This list shall be named **SYS:POLL_LIST** and have the form:

>   device address, POLL = (word 1, [word 2, ..., word n]),
>   TIMEOUT = time,
>   RETRY = number
>   [CYCLE = cycles per **poll**]

where 'device address' is the multiplexer addresser, multiplexer channel number, **site** ID, and **subsite** ID. POLL shall specify the message to be sent

1-20.3.8.5.2.5 Quality Assurance Provisions.- This Procedure shall be verified by processing a simulation tape generated under **DU4.** All error traps shall be exercised. The saturation condition shall be tested by gradually increasing the 'clock rate' parameter until the warning message occurs. Proper dispatch of messages shall be verified in the EVENT mode, comparing the tape dump obtained under **DU4** with the resultant displays. Service A dispatch shall be verified by checking printed output from the Service A processor stub. **HALTT** and **HALTE** halt modes shall be verified by comparing manual predictions of display output with **actuals.** The **HS** command shall be tested at a low clock rate where it can be verified that the halt is accepted immediately. The **RS** command shall be tested and parameter carryover and override shall be verified. ES termination and return to the operating system shall be observed.

1-20.3.9 Demonstrable Unit 7 **- FPU** Polling.- This **DU** describes the following function:

> Definition of **FPU** Poll List
> **FPU** poll generation
> **Responde** checks

1-20.3.9.1 System Components Required.- **CPS, CPS** operator console, **FPU** communications interface, and **FPU** equipped test device.

1-20.3.9.2 Other Demonstrable Units Required.- **DU1, DU2, DU3, DU4,** and **DU6.**

1-20.3.9.3 Function 1 **-** Definition of **FPU** Poll List.- This function describes the definition of the **FPU** Poll List. The primary external input source to the **CPS** is the network of polled **FPUs.** The sequence and frequency of polling shall be determined by a user defined list.

1-20.3.9.3.1 External Inputs.- The user shall enter data into, or modify, the **FPU** Polling List via the Modify List (ML) command. This list shall be named **SYS:POLL_LIST** and have the form:

> device address, POLL = (word 1, [word 2, ..., word n]),
> TIMEOUT = time,
> RETRY = number
> [CYCLE = cycles per **poll**]

where 'device address' is the multiplexer addresser, multiplexer channel number, **site** ID, and **subsite** ID. POLL shall specify the message to be sent

1-20.3.9.4.2 Functional Processing.- The **CPS** shall transmit the poll messages defined in the Poll list on a cyclic basis. The time interval between transmission shall be determined by adaptation data and shall be modifiable by the level 2 user or automatically by the system when necessary.

Poll messages shall be transmitted in order of their appearance in the poll list. Those devices which have CYCLE values greater than 1 specified, shall be polled on the initial cycle and on each succeeding **nth** cycle (as specified by the value of the CYCLE keyword).

1-20.3.9.4.3 External **Outputs.-** The message transmitted shall consist of the defined poll plus any leading or trailing characters required by the adopted external message protocol.

1-20.3.9.4.4 Error Processing.- Upon transmission of a poll message, the poll generator shall start timing the response time delay. If no response is received from the device addressed within the time interval specified (adaptation parameter), the poll message shall be retransmitted. If this fails to elicit a response, the procedures shall be retried (adaptation parameter) a number of times. If this procedure produces no reply: POLL TRANSMISSION **FAILURE:device** address DOES NOT RESPOND TO POLL shall be displayed on the **CPS** operator and maintenance consoles and the audible alarm sounded.

This function shall also detect fatal message transmission errors caused by multiplexed or line failures and shall display the following message on the **CPS** operator and **mainenance** consoles:

        POLL TRANSMISSION **FAILURE:MESSAGE** TO device NOT
        SUCCESSFULLY TRANSMITTED

The **CPS** operator and maintenance consoles audible alarms shall be sounded.

Failures of these types shall be recorded as Event Messages.

1-20.3.9.4.5 Quality Assurance **Provisions.-** Testing of this function shall be incorporated into **FPU** response testing and is described in Section **1-20.3.9.5**

1-20.3.9.5 Function 3 **-- FPU** Response Checks. **--** This function describes the preliminary processing of **CPS** input messages from **FPUs.**

<u>1-20.3.9.5.1 External Inputs.</u>- FPU messages received in response to poll.

<u>1-20.3.9.5.2 Functional Processing.</u>- This function shall perform a cyclic redundancy check (CRC) in accordance with ICD Level I. If the CRC fails, the poll message shall be retransmitted. If a number (adaptation data) of successive CRC checks fail from a given FPU, the message:

> Input message error:device address MESSAGE FAILS CYCLIC
> REDUNDANCY CHECK

shall be displayed on the CPS operator console and the maintenance console and the audible alarm shall be sounded.

A validated message shall be dispatched to the message input decoder described in Section 1-20.3.8.4.

<u>1-20.3.9.5.3 External Outputs.</u>- Poll message retries in response to CRC failures.

<u>1-20.3.9.5.4 Error Processing.</u>- Described in Section 1-20.3.9.5.2 above.

<u>1-20.3.9.5.5 Quality Assurance Provisions.</u>- This function shall be verified by using a programmable microprocessor equipped test device which shall be capable of displaying and responding to poll messages from the CPS. This test device shall be used to simulate valid inputs and to test all defined poll error modes. Correct processing of FPU messages shall be verified through display of messages, alerts, and alarms on the SMDs, critical displays, and supplementary displays.

<u>1-20.3.10 Demonstrable Unit 8 - Process Service A Messages</u>

<u>1-20.3.10.1 Functional Capabilities Description.</u>- This DU provides the capability of detecting each group and message distributed over Service A, and of parsing the weather messages in the SA group into smaller data elements for display. The other messages may be displayed in their entirety. Messages which cannot be detected or parsed, are queued and displayed in turn for editing by the operator of an SMD.

<u>1-20.3.10.2 System Components Required.</u>- CPS, SMD, Service A interface, and Service A 240 baud drop.

<u>1-20.3.10.3 Other Demonstrable Units Required.</u>- DU1, DU2, DU3, and DU4.

1-20.3.9.5.1 External Inputs.- FPU messages received in response to poll.

1-20.3.9.5.2 Functional Processing.- This function shall perform a cyclic redundancy check (CRC) in accordance with ICD Level I. If the CRC fails, the poll message shall be retransmitted. If a number (adaptation data) of successive CRC checks fail from a given FPU, the message:

>   Input message error:device address MESSAGE FAILS CYCLIC
>   REDUNDANCY CHECK

shall be displayed on the CPS operator console and the maintenance console and the audible alarm shall be sounded.

A validated message shall be dispatched to the message input decoder described in Section 1-20.3.8.4.

1-20.3.9.5.3 External Outputs.- Poll message retries in response to CRC failures.

1-20.3.9.5.4 Error Processing.- Described in Section 1-20.3.9.5.2 above.

1-20.3.9.5.5 Quality Assurance Provisions.- This function shall be verified by using a programmable microprocessor equipped test device which shall be capable of displaying and responding to poll messages from the CPS. This test device shall be used to simulate valid inputs and to test all defined poll error modes. Correct processing of FPU messages shall be verified through display of messages, alerts, and alarms on the SMDs, critical displays, and supplementary displays.

1-20.3.10 Demonstrable Unit 8 - Process Service A Messages

1-20.3.10.1 Functional Capabilities Description.- This DU provides the capability of detecting each group and message distributed over Service A, and of parsing the weather messages in the SA group into smaller data elements for display. The other messages may be displayed in their entirety. Messages which cannot be detected or parsed, are queued and displayed in turn for editing by the operator of an SMD.

1-20.3.10.2 System Components Required.- CPS, SMD, Service A interface, and Service A 240 baud drop.

1-20.3.10.3 Other Demonstrable Units Required.- DU1, DU2, DU3, and DU4.

nnn
(text)
SAUS 1 **KNKA dtg**

where:

nnn is the **WMSC** message number
(text) is an optional user specified text
dtg is the date time group - **ddhhmm**

dd = day of month - 01-31
hh = hour - 00-23
mm = minutes - 00-59

The **SA** group messages, if present, following immediately after the header, each one starting on a new line. Each **SA** group message contains the following fields:

(a) Origin: A three character alphanumeric field beginning at a new line and containing at least one alphabetic character. Terminated by a space.

(b) Message Type: **SA** - surface analysis
                      SP - special surface analysis
                      RS - record special (an **SP** after **45** minutes
                             after the hour and before the Al poll)
                     USP - urgent special surface analysis
                       SW - supplementary weather
                     SW **SP** - special supplementary weather
                    FINO - no information available
                 MISSING - no reply from **WMSC** poll
                    AMOS - automated **SA**
                    !ooo - **NOTAM** (Notice to Airman) where **ooo** is the
                             same origin encountered in field **one**.
                Terminated by one space.

(Note: If the second field is **FINO** or MISSING, no further fields are expected or processed. If the message is **AMOD,** the time, sky condition, visibility and obstruction to visibility are not present.)

1-20.3.10.4.1.1.1 External Input for Weather Messages.- The weather messages **(SA, RS, SP, USP,** SW, SW **SP,** AMOS) contain the following additional fields:

(c)* Correction: (Optional) **COR** to indicate this is a correction
to the immediately preceding message from this origin.

(d)* Time: Four digits representing hours and minutes from 0000 to
2359.

(e)* Sky Condition: Maximum of **56** characters terminated by the
last occurrence of one of the following prior to a slash (/):

CLR   SCT   BKN   OVC   X

(f)* Visibility: One or two numeric characters optionally followed
by a slash and **2, 4, 8,** or **16.** Terminated by a space or an
alphabetic character.

(g)* Weather and Obstruction to Visibility: (Optional) If present
consists of maximum of **14** characters, all of which must be
alphabetic, **+,** or **-.** Terminated by a space;

(h) Barometric Pressure in Millibars: (Optional) Three numeric
characters terminated by a slash.

(i) Temperature: (Optional, but must be present if field 8 is
present.) **Two** or three numeric characters (including a leading
minus sign) or M terminated by a slash. (If 3 characters, leading
character must be 1 or minus sign.)

(j) Dew Point: (Occurs if and only if temperature is found.) Same
as temperature. Must be algebraically less than or equal to
temperature. Terminated by a slash.

(k) Wind Direction: Two numeric characters terminated by wind
speed field.

(m) Wind Speed: Two numeric characters optionally followed by the
letter G and two more numeric characters. Terminated by a slash.

Note: Wind direction and speed of **0000** is used to indicate calm,
9999 is used to indicate light and variable.

(n) Altimeter Setting: The integer, tenths, and **hundreths** digits
of the barometric pressure in inches of mercury corrected to mean
sea level. Terminated by a space, a slash **(/),** or a **NOTAM**
designator **(!).** (If a **NOTAM** designator is present, a **NOTAM** message
follows.).

* Not found in an AMOS message.

(p) Remarks: (Optional following barometric pressure field
terminated by a space or a slash) Up to 60 characters including any
space terminating the barometric pressure field.   Terminated by end
of message, UA, or the NOTAM designator (!). If a UA or NOTAM
designator is present, a UA or NOTAM message follows.   The NOTAM
designator is followed by the same three character origin designator
as the weather message.   If the origin designator is followed by an
'ampersand (&), the text is a list of currently active NOTAMS.

1-20.3.10.4.1.1.2 External Input for NOTAM Messages.- The NOTAM messages
contain the following fields in addition to fields (a) and (b) described in
Section 1-20.3.10.4.1.1:

(c) NOTAM number: One or two digit number from one to twelve
followed by a slash and a one to three digit number from one to 999.
Terminated by a space.

(d) Contents: NOTAM text terminated by the next message.

1-20.3.10.4.1.1.3 External Input for NOTAM Cancellation Message.- The
NOTAM cancellation messages contain the following fields in addition to
fields (a) and (b) described in Section 1-20.3.10.4.1.1:

(c) Cancellation indicator: C to indicate cancellation.

(d) NOTAM number: Same as NOTAM number for NOTAM message.
Terminated by a space.

(e) THRU number: (Optional) Indicates range of NOTAMs to be
cancelled.   Number format is same as NOTAM number above.   Field is
terminated by a space.

1-20.3.10.4.1.2 Functional **Processing.-** The message shall be detected by
recognizing the origin and message type fields.   If the message type is
FINO or MISSING, no further fields shall be processed in this message. If
the origin is not one of the origins of interest for this site (as
determined by adaptation data), no further fields shall be processed in
this message.   If the first two fields of the line do not conform to the
format of the origin and message type fields, the next line shall be
examined.   If the message type is NOTAM, the first field of the NOTAM shall
be deleted and the remaining fields processed as described in the NOSUM
group access. Otherwise, the message is a weather message and the fields
shall be processed as specified below, if data elements are defined for the
receipt of the field:

(p) Remarks: (Optional following barometric pressure field terminated by a space or a slash) Up to 60 characters including any space terminating the barometric pressure field. Terminated by end of message, UA, or the NOTAM designator (!). If a UA or NOTAM designator is present, a UA or NOTAM message follows. The NOTAM designator is followed by the same three character origin designator as the weather message. If the origin designator is followed by an 'ampersand (&), the text is a list of currently active NOTAMS.

1-20.3.10.4.1.1.2 External Input for NOTAM Messages.- The NOTAM messages contain the following fields in addition to fields (a) and (b) described in Section 1-20.3.10.4.1.1:

(c) NOTAM number: One or two digit number from one to twelve followed by a slash and a one to three digit number from one to 999. Terminated by a space.

(d) Contents: NOTAM text terminated by the next message.

1-20.3.10.4.1.1.3 External Input for NOTAM Cancellation Message.- The NOTAM cancellation messages contain the following fields in addition to fields (a) and (b) described in Section 1-20.3.10.4.1.1:

(c) Cancellation indicator: C to indicate cancellation.

(d) NOTAM number: Same as NOTAM number for NOTAM message. Terminated by a space.

(e) THRU number: (Optional) Indicates range of NOTAMs to be cancelled. Number format is same as NOTAM number above. Field is terminated by a space.

1-20.3.10.4.1.2 Functional Processing.- The message shall be detected by recognizing the origin and message type fields. If the message type is FINO or MISSING, no further fields shall be processed in this message. If the origin is not one of the origins of interest for this site (as determined by adaptation data), no further fields shall be processed in this message. If the first two fields of the line do not conform to the format of the origin and message type fields, the next line shall be examined. If the message type is NOTAM, the first field of the NOTAM shall be deleted and the remaining fields processed as described in the NOSUM group access. Otherwise, the message is a weather message and the fields shall be processed as specified below, if data elements are defined for the receipt of the field:

(p) If the remarks field is present, it shall be placed in the remarks data element. If the remarks field is longer than the length of the data element, the weather message shall be sent to the Service A editing console.

(q) If a **NOTAM** or **UA** message follows, it shall be processed by the **NOTAM** or **UA** message processing functions of the **NOSUM** and **UB** group processing respectively. If a list of **NOTAMs** follows, it shall be discarded.

1-20.3.10.4.1.3 External Outputs

Data elements specified as being set in the functional. processing section.

SA messages to the Service A edit console with an indication of location of the discrepancy.

NOTAM messages to the **NOSUM** group process.

UA messages to the **UB** group process.

1-20.3.10.4.1.4 Error Processing.- If a message that is determined to be for an origin of interest for this site fails to conform to the specified input format, the message shall be output to the Service A editing console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements. If the sky condition or remarks field is longer than the specified length, the message shall be output to the Service A editing console with an indication of the cause and location of the discrepancy, and this shall also inhibit placing fields in data elements.

1-20.3.10.4.1.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that all numeric fields are correctly processed at and on each side of any boundary condition values, that status-type fields are correctly processed at all values, that both presence and absence of optional fields is correctly processed and that field size constraints are properly applied. These guidelines are elaborated for each field. Acceptance of all valid field terminating values and rejection of at least one invalid field terminator shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest shall be accepted. At least one valid origin not of interest shall be rejected. It shall be demonstrated that the invalid origin causes display at the operations **SMD** and the valid origin not of

interest does not. The valid origins shall include all 7 valid
combinations of alphabetic with numeric characters. It shall be
demonstrated that all 7 combinations are not rejected as invalid.
Origins that are all numeric, too short, too long, or terminated by
a character other than a space shall be rejected. (Since presence
of a valid origin is used to detect SA group messages, validity
checking is limited to the first message of a group and corrected
messages input from the Service A edit console.)

(b) Message Type: Acceptance of all valid message types shall be
demonstrated. Rejection of invalid message types shall be
demonstrated. Rejection of a NOTAM with a non-matching origin shall
be demonstrated. Ignoring of additional fields in MISSING and FINO
messages shall be demonstrated. Rejection of time, sky condition,
visibility, and obstruction to visibility fields within AMOS
messages shall be demonstrated. Use of the SA group time using the
same values as required for the normal time field for AMOS messages
shall be demonstrated. Further quality assurance for the NOTAM
message is performed under NOSUM group processing. Transformation
of an SW SP message to an SP shall be demonstrated.

(c) COR: Accepting messages with and without the COR field shall
be demonstrated.

(d) Time: Accepting messages with 0000, 0001, 2358, 2359 shall be
demonstrated. Rejecting non-numeric characters, 2400, 0060, 3000
shall be demonstrated, for AMOS and normal messages.

(e) Sky Condition: Acceptance of messages of length equal to that
of the data field shall be demonstrated. Correct transmission to
the Service A edit position of messages one character longer shall
be demonstrated. Acceptance of CLR, SCT, BKN, OVC, and X as the
last character shall be demonstrated. Acceptance of a single one of
these or all five shall be demonstrated.

(f) Visibility: Rejection of any non-numeric character than a
slash in the next to last or next to next to last position shall be
demonstrated. Acceptance of one and two numerics without a slash
(/), /16 preceded by a numeric and /2, /4, and /8 preceded by one
and two numerics shall be demonstrated.

interest does not. The valid origins shall include all 7 valid
combinations of alphabetic with numeric characters. It shall be
demonstrated that all 7 combinations are not rejected as invalid.
Origins that are all numeric, too short, too long, or terminated by
a character other than a space shall be rejected. (Since presence
of a valid origin is used to detect SA group messages, validity
checking is limited to the first message of a group and corrected
messages input from the Service A edit console.)

(b) Message Type: Acceptance of all valid message types shall be
demonstrated. Rejection of invalid message types shall be
demonstrated. Rejection of a NOTAM with a non-matching origin shall
be demonstrated. Ignoring of additional fields in MISSING and FINO
messages shall be demonstrated. Rejection of time, sky condition,
visibility, and obstruction to visibility fields within AMOS
messages shall be demonstrated. Use of the SA group time using the
same values as required for the normal time field for AMOS messages
shall be demonstrated. Further quality assurance for the NOTAM
message is performed under NOSUM group processing. Transformation
of an SW SP message to an SP shall be demonstrated.

(c) COR: Accepting messages with and without the COR field shall
be demonstrated.

(d) Time: Accepting messages with 0000, 0001, 2358, 2359 shall be
demonstrated. Rejecting non-numeric characters, 2400, 0060, 3000
shall be demonstrated, for AMOS and normal messages.

(e) Sky Condition: Acceptance of messages of length equal to that
of the data field shall be demonstrated. Correct transmission to
the Service A edit position of messages one character longer shall
be demonstrated. Acceptance of CLR, SCT, BKN, OVC, and X as the
last character shall be demonstrated. Acceptance of a single one of
these or all five shall be demonstrated.

(f) Visibility: Rejection of any non-numeric character than a
slash in the next to last or next to next to last position shall be
demonstrated. Acceptance of one and two numerics without a slash
(/), /16 preceded by a numeric and /2, /4, and /8 preceded by one
and two numerics shall be demonstrated.

(q) **NOTAM** or **UA** Message: Forwarding of a **UA** message to the **UB** group process shall be demonstrated. Discarding a list of **NOTAMs** which is detected by the presence of an ampersand **(&)** following the origin shall be demonstrated.   Rejection of a **NOTAM** which has an origin unequal to the origin of the **SA** message shall be demonstrated.   Forwarding of **NOTAMS** that are not rejected as described above shall be demonstrated.

1-20.3.10.4.2 Procedure 2 - NOSUM Group Processing

1-20.3.10.4.2.1 External **Inputs.-** The **NOSUM** group process shall accept for processing **NOTAM** messages detected by the **SA** group processing procedure and message groups with the following three line header:

>   nnn
>   (text)
>   NOSUM KNKA dtg

where:

>   nnn is the WMSC message number
>   (text) is an optional user specified text
>   dtg is the date time group (ddhhmm)
>   dd = day of month, hh = hour, mm = minute

The **NOSUM** group messages are all **NOTAM** messages. Each message starts on a new line.   **NOTAM** messages received from the **SA** group processing procedure need not start on a new line.   All **NOTAM** messages have the following fields:

(a) **!ooo** - where **ooo** is the three character origin at least one character of which must be alphabetic. Terminated by a space.

(b) C - (optional on **NOTAMs** received from **SA** process only) indicates cancellation of **NOTAMs.** Terminated by sequence number.

(c) m/n - where m is a one or two digit number denoting the month of the year and n is one, two, or three digit number indicating the **NOTAM** within the month.

(d) THRU m/n - (optional on cancellation message only) indicates all **NOTAMs** from starting number to this number are to be canceled.

(e) text – text of **NOTAM.**   (Does not occur in cancellation messages.)

1-20.3.10.4.2.2 Functional **Processing.-** The first character of every line of the **NOSUM** group shall be examined until an exclamation point **(!)** indicating the start of a **NOTAM** or **NOTAM** cancellation has been encountered. The **NOTAM** shall then be processed and the search for the next **NOTAM** continued from the end of this **NOTAM.** This shall be continued until the end of the **NOSUM** group is encountered. Each field of the **NOTAM** message, whether part of the **NOSUM** group or not, shall be stored if the message is not rejected, the origin is an origin of interest and there is a data element defined for the field. The processing of each field shall be as follows:

> (a) If the origin field is recognized as not being an origin of interest, the message shall be discarded. Otherwise, the origin field shall be placed in the **NOTAM** data element.

> **(b)** The **NOTAM** number field shall be placed in the **NOTAM** data element.

> **(c)** The **NOTAM** text field shall be placed in the **NOTAM** text data element. If the length of the **NOTAM** exceeds the length of the data element, the **NOTAM** shall be sent to the Service A edit console.

If the message is a **NOTAM** cancellation message, the message specified, or all messages specified, shall be canceled by deleting them from the data base.

1-20.3.10.4.2.3 External Outputs

> Data elements specified as being set in the functional processing section.
> **NOTAM** messages to the editing console with indications of the location of the discrepancy.
> Canceled (deleted) **NOTAM** messages.

1-20.3.10.4.2.4 Error **Processing.-** If a message that is determined to be for an origin of interest for this site fails to conform to the specified input format, or if the **NOTAM** text is longer than the length of the data element, the message shall be output to the editing console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.2.5 Quality Assurance Provisions.- The acceptance testing is intended to **demonstrate** that status type fields are correctly processed for

(e) text - text of NOTAM. (Does not occur in cancellation
messages.)

1-20.3.10.4.2.2 Functional **Processing.-** The first character of every line
of the NOSUM group shall be examined until an exclamation point **(!)**
indicating the start of a NOTAM or NOTAM cancellation has been encountered.
The NOTAM shall then be processed and the search for the next NOTAM
continued from the end of this NOTAM. This shall be continued until the
end of the NOSUM group is encountered. Each field of the NOTAM message,
whether part of the NOSUM group or not, shall be stored if the message is
not rejected, the origin is an origin of interest and there is a data
element defined for the field. The processing of each field shall be as
follows:

> (a) If the origin field is recognized as not being an origin of
> interest, the message shall be discarded. Otherwise, the origin
> field shall be placed in the NOTAM data element.
>
> **(b)** The NOTAM number field shall be placed in the NOTAM data
> element.
>
> **(c)** The NOTAM text field shall be placed in the NOTAM text data
> element. If the length of the NOTAM exceeds the length of the data
> element, the NOTAM shall be sent to the Service A edit console.

If the message is a NOTAM cancellation message, the message specified, or
all messages specified, shall be canceled by deleting them from the data
base.

1-20.3.10.4.2.3 External Outputs

> Data elements specified as being set in the functional processing
> section.
> NOTAM messages to the editing console with indications of the
> location of the discrepancy.
> Canceled (deleted) NOTAM messages.

1-20.3.10.4.2.4 Error **Processing.-** If a message that is determined to be
for an origin of interest for this site fails to conform to the specified
input format, or if the NOTAM text is longer than the length of the data
element, the message shall be output to the editing console with an
indication of the location of the discrepancy, and no fields from the
message shall be placed in data elements.

1-20.3.10.4.2.5 Quality Assurance Provisions.- The acceptance testing is
intended to **demonstrate** that status type fields are correctly processed for

The FDC NOTAM grc proce&s shall discard all FDC NOTAM list groups. These
have the followi; formal·

        nnn
        FDC LIST mo ith dtg

where:

        nnn is the /MSC number
        month is the current month spelled in full
        dtg is the date time group

There is a single message in the FDC NOTAM group which may be a NOTAM
cancel, or a NOTAM message consisting of NOTAM text. The NOTAM cancel
consists of the follow.ng:

        (a) CANCEL - Indication this is a cancel message. Terminated by a
        space.

        (b) FDC - Redundant field. Terminated by a space.

        (c) n/number - FD? NOTAM number of NOTAM being canceled. 'Number'
        is 1 to 4 digits. Terminated by a space.

1-20.3.10.4.3.2 Functional Processing.- If the message is a NOTAM, the following processing shall be performed:

        (a) Origin: If FDC is not an origin of interest for this site, the
        message shall be discarded.

        (b) NOTAM number: The NOTAM number field shall be placed in the
        NOTAM data element.

        (c) text: The NOTAM text field shall be placed in the NOTAM data
        element appended to the NOTAM number.

If the message is a NOTAM, cancel the NOTAM specified by the NOTAM number
field shall be deleted.

1-20.3.10.4.3.3 External Outputs

        Data elements specified as being set in the functional processing
        section.
        NOTAM messages to the editing console with indications of the
        location of the discrepancy.
        Canceled (deleted) NOTAM messages.

1-20.3.10.4.3.4 Error Processing.- If **FDC** messages are of interest for this site and the message fails to conform to the specified input format, the message shall be output to the editing console with an indication of the location of the discrepancy and no fields from the message shall be placed in data elements. If the **NOTAM** text is longer than the length specified for the data element, the message shall be output to the editing console, with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.3.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields shall be correctly processed for all values , that both presence and absence of optional fields shall be correctly processed and that field size constraints shall be correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value -shall be demonstrated for each field processed.

The following features shall be demonstrated for the **FDC** cancel **NOTAM:**

> (a) CANCEL: Processing of at least one similar sequence of letters in this field as a **FDC NOTAM** and acceptance of this field shall be demonstrated.

> **(b) FDC:** Processing of a similar sequence of letters in this field (after a "CANCEL") as an **FDC NOTAM** and acceptance of this field shall be demonstrated.

> **(c) FDC NOTAM** Number: Rejection of **0n/nnn, 0n/nnnn, 0/0000** and **n/0nnnn** and acceptance of **0/1** and **9/9999** shall be demonstrated. Rejection of alphabetic characters in all five numeric places shall be demonstrated. Rejection of n **nnnn** shall be demonstrated. Deletion of the **NOTAM** and correct processing if there are no **NOTAMS** shall be demonstrated. Discrimination between an **FDC NOTAM** and an ordinary **NOTAM** with the same number shall be demonstrated.

The following features shall be demonstrated for the **FDC NOTAM** MESSAGE:

> (a) The same **FDC NOTAM** number shall be accepted and rejected as in the **FDC** cancellation **NOTAM.**

> **(b)** If an **FDC NOTAM** with the same number is present, this **NOTAM** shall be sent to the Service A edit console.

1-20.3.10.4.3.4 <u>Error Processing</u>.- If **FDC** messages are of interest for this site and the message fails to conform to the specified input format, the message shall be output to the editing console with an indication of the location of the discrepancy and no fields from the message shall be placed in data elements. If the **NOTAM** text is longer than the length specified for the data element, the message shall be output to the editing console, with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.3.5 <u>Quality Assurance **Provisions.-**</u> The acceptance testing is intended to demonstrate that status type fields shall be correctly processed for all values , that both presence and absence of optional fields shall be correctly processed and that field size constraints shall be correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value -shall be demonstrated for each field processed.

The following features shall be demonstrated for the **FDC** cancel **NOTAM:**

    (a) CANCEL: Processing of at least one similar sequence of letters in this field as a **FDC NOTAM** and acceptance of this field shall be demonstrated.

    (b) FDC: Processing of a similar sequence of letters in this field (after a 'CANCEL') as an **FDC NOTAM** and acceptance of this field shall be demonstrated.

    (c) FDC NOTAM Number: Rejection of **0n/nnn, 0n/nnnn, 0/0000** and **n/0nnnn** and acceptance of **0/1** and **9/9999** shall be demonstrated. Rejection of alphabetic characters in all five numeric places shall be demonstrated. Rejection of n **nnnn** shall be demonstrated. Deletion of the **NOTAM** and correct processing if there are no **NOTAMS** shall be demonstrated. Discrimination between an **FDC NOTAM** and an ordinary **NOTAM** with the same number shall be demonstrated.

The following features shall be demonstrated for the **FDC NOTAM** MESSAGE:

    (a) The same **FDC NOTAM** number shall be accepted and rejected as in the **FDC** cancellation **NOTAM.**

    (b) If an **FDC NOTAM** with the same number is present, this **NOTAM** shall be sent to the Service A edit console.

(b) message text: The text field shall be placed in the text data element, truncated if necessary.

If the message is a **CARF NOTAM** cancellation, the **CARF NOTAM** to be canceled (as determined from field **3)** shall be deleted.

1-20.3.10.4.4.3 External Outputs

Data elements specified as being set in the functional processing section.
Canceled (deleted) **CARF NOTAM** message.
NOTAM messages to the editing console with indications of the location and type of discrepancy.

1-20.3.10.4.4.4 Error **Processing.-** If **CARF** messages are of interest to this site and the message fails to conform to the specified input format, the message shall be output to the editing console with an indication of the location and cause of the discrepancy and no fields from the message shall be placed in data elements. If the **NOTAM** text or number is longer than the length specified for the data element , or if the number field or the number of the **NOTAM** to be canceled contain non-numeric characters, the message shall be output to the editing console with an indication of the location of the discrepancy , and no fields from the message shall be stored. If a **CARF NOTAM** number is greater than the data element for a **NOTAM** to be canceled cannot be found, the message shall be output to the Service A edit console with an indication of the location of the discrepancy and no fields from the message shall be stored.

1-20.3.10.4.4.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid termination value shall be demonstrated for each field processed. The following features shall be demonstrated for the **CARF NOTAM.**

(a) **CARF NOTAM NR:** Rejection of alphanumeric characters between **"CARF"** and **"NOTAM"** and between **"NOTAM"** and **"NR"** shall be demonstrated. Rejection of misspelling of **"CARF", "NOTAM",** and **"NR"** shall be demonstrated.

(b) Number field: Rejection of alphabetic characters shall be demonstrated. Rejection of fields which contain two or four numerals and of fields which contain a non-numeric character shall be demonstrated. Acceptance of numbers that are the same size as the data element shall be demonstrated. Discarding of **NOTAMs** with numbers duplicating presently stored **NOTAM** numbers shall be demonstrated.

(c) text: Storing of text equal in length to the data element shall be demonstrated. Truncation of text one character longer than the data element and sending the message to the editing console with an indication of the location and cause of the discrepancy shall be demonstrated.

The following features shall be demonstrated for the **CARF NOTAM** cancellation:

(a) **CARF NOTAM NR:** Same as **CARF NOTAM.**

(b) Number field: Same as **CARF NOTAM.**

(c) text: Rejection of alphanumeric characters between "CANCEL", **"CARF", "NOTAM",** and **"NR"** shall be demonstrated. The **same** features of the number field above. Deletion of a **CARF NOTAM** and sending of the message to the Service A edit console when no **CARF NOTAM** is found with a matching **CARF NOTAM** number.

1-20.3.10.4.5 Procedure 5 - UB Group Processing

1-20.3.10.4.5.1 External Inputs.- The **UB** group process shall accept for processing message groups with the following three line header:

> **nnn**
> (text)
> **UBUS 1 KNKA dtg**

where:

> **nnn** is the **WMSC** message number
> (text) is an optional user specified text
> **dtg** is the date time group

(b) Number field: Rejection of alphabetic characters shall be demonstrated. Rejection of fields which contain two or four numerals and of fields which contain a non-numeric character shall be demonstrated. Acceptance of numbers that are the same size as the data element shall be demonstrated. Discarding of **NOTAMs** with numbers duplicating presently stored **NOTAM** numbers shall be demonstrated.

(c) text: Storing of text equal in length to the data element shall be demonstrated. Truncation of text one character longer than the data element and sending the message to the editing console with an indication of the location and cause of the discrepancy shall be demonstrated.

The following features shall be demonstrated for the **CARF NOTAM** cancellation:

(a) **CARF NOTAM NR:** Same as **CARF NOTAM.**

(b) Number field: Same as **CARF NOTAM.**

(c) text: Rejection of alphanumeric characters between "CANCEL", **"CARF"**, **"NOTAM"**, and **"NR"** shall be demonstrated. The **same** features of the number field above. Deletion of a **CARF NOTAM** and sending of the message to the Service A edit console when no **CARF NOTAM** is found with a matching **CARF NOTAM** number.

1-20.3.10.4.5 Procedure 5 - UB Group Processing

1-20.3.10.4.5.1 External Inputs.- The **UB** group process shall accept for processing message groups with the following three line header:

nnn
(text)
UBUS 1 KNKA dtg

where:

nnn is the **WMSC** message number
(text) is an optional user specified text
dtg is the date time group

of the report. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.5.3 External Outputs

Data elements specified as being set in the functional processing section.

UA or **UUA** messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.5.4 Error Processing.- If a message that is determined to be for an origin of interest for this site fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.5.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest (if there are at least three) shall be accepted. At least one valid origin not of interest shall be rejected. It shall be demonstrated that an invalid origin causes an edit alert and the valid origin not of interest does not. Origins that are too short, too long, or terminated by a character other than a space shall be rejected.

(b) Message type: Acceptance of both valid message types shall be demonstrated. Rejection of an invalid message type shall be demonstrated.

(c) **/OV:** Acceptance of messages with the **/OV** field in the proper place shall be demonstrated. Rejection of /lb, ARC, 1 to **/OV,** and A to **/OV** in place of **/OV** shall be demonstrated.

(d) Time: Acceptance of messages with **0000, 0001, 2358,** and **2359** shall be demonstrated. Rejection of non-numeric characters, **2400, 0060,** and **3000** shall be demonstrated.

1-20.3.10.4.6 Procedure 6 - AC Group Processing

1-20.3.10.4.6.1 External Inputs.- The AC group process shall accept for processing message groups with the following three line header:

        nnn
        (text)
        MKC AC **dtg**

where:

        nnn is the **WMSC** message number
        (text) is an optional user specified text
        dtg is the date time group

The AC message is further identified for each validity **period.** This period is on the first line after the header and has the following format:

        VALID **dtg-dtgZ**

The remainder of the message is the AC message and it ends with the group end of message.

AC message groups are input from the Service A line directly. Individual AC **messges** are also received from the edit and correction procedure.

1-20.3.10.4.6.2 Functional Processing.- The AC groups shall be recognized by detection of the entire header. Individual AC messages shall be detected by the validity field starting on a new line.

If the time of receipt of the message is past the end of the validity period, the message shall be discarded. Otherwise, each message, together with the last line of the header, shall be placed into an associated data element, if one has been defined, where expiration time is the end of the validity period. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

(d) Time: Acceptance of messages with **0000, 0001, 2358,** and **2359** shall be demonstrated. Rejection of non-numeric characters, **2400, 0060,** and **3000** shall be demonstrated.

1-20.3.10.4.6 Procedure 6 - AC Group Processing

1-20.3.10.4.6.1 External Inputs.- The AC group process shall accept for processing message groups with the following three line header:

    nnn
    (text)
    MKC AC **dtg**

where:

    nnn is the **WMSC** message number
    (text) is an optional user specified text
    dtg is the date time group

The AC message is further identified for each validity **period.** This period is on the first line after the header and has the following format:

    VALID **dtg-dtgZ**

The remainder of the message is the AC message and it ends with the group end of message.

AC message groups are input from the Service A line directly. Individual AC **messges** are also received from the edit and correction procedure.

1-20.3.10.4.6.2 Functional Processing.- The AC groups shall be recognized by detection of the entire header. Individual AC messages shall be detected by the validity field starting on a new line.

If the time of receipt of the message is past the end of the validity period, the message shall be discarded. Otherwise, each message, together with the last line of the header, shall be placed into an associated data element, if one has been defined, where expiration time is the end of the validity period. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

The **WW** message follows the header starting on a new line and ending with the end of this message group. The message is identified by searching the message for the word NUMBER or **NR** and using the next field, which must be a three digit numeric, as the message number.

A **WW** message may be canceled in two ways. The first is when the header is received and the word CANCEL is encountered prior to encountering the message number. The second way to cancel a **WW** message is after receipt of the following header:

> **nnn**
> (text)
> **MKC AWW dtg**

where:

> **nnn** is the **WMSC** message number
> (text) is an optional user specified text
> **dtg** is the date time group

The next line will be in the following format:

> **WWmmm** (text) CANCELED

where:

> **mmm** is the **WW** message number
> (text) is any text with the exception of the characters CANCEL

The second way to amend a **WW** message is the receipt of the following header:

> **nnn**
> (text)
> **MKC WW-A dtg**

where:

> **nnn** is the **WMSC** message number
> (text) is an optional user specified text
> **dtg** is the date time group

The **WW** amendment is further identified by searching the message for the
word **NUMBER** or **NR** and using the next field, which must be a three digit
numeric, as the message number.

WW message groups are input from the Service A line directly. Individual
WW messages are also received from the edit and correction procedure.

1-20.3.10.4.7.2 Functional Processing.- The **WW** groups shall be recognized
by detection of the entire header. Individual **WW** messages shall be
detected by recognizing text on a new line following the header. Each new
WW message shall be placed with the third line of the header into an
associated data element, if one has been defined, whose data element name
is the **WW** message number, and whose expiration time is until canceled. If
an associated data element has not been defined, the message shall be
discarded. If the length of the message exceeds the length of the data
element, the message shall be sent to the Service A edit console.

Each **WW** amendment message with the last line of its header shall be
appended to the original **WW** message with the same **WW** message number, if a
data element with the same **WW** message number exists. If a data element
with the same **WW** message number does not exist, or if the length of the
original and appended messages exceeds the length of the data element, the
combined message shall be sent to the Service A edit console.

If a **WW** cancel message is received, the associated data element containing
a **WW** message with the same **WW** message number as that of the cancel message
shall be removed from the data base. If no **WW** message data element has
been defined, or if no defined **WW** message data element contains the same **WW**
message numbers as that of the cancel message, the cancel message shall be
sent to the Service A edit console.

1-20.3.10.4.7.3 External Outputs

> Data elements specified as being set in the functional-processing
> section.
> **WW** messages to the Service A edit console with an indication of the
> location of the discrepancy.

1-20.3.10.4.7.4 Error **Processing.-** If a message fails to conform to the
specified input format, if a duplicate **WW** message number exists, if an
amendment or-cancel massage has no corresponding original message, or if
the length of a field exceeds the length of the data element into which it

The **WW** amendment is further identified by searching the message for the word **NUMBER** or **NR** and using the next field, which must be a three digit numeric, as the message number.

WW message groups are input from the Service A line directly. Individual **WW** messages are also received from the edit and correction procedure.

1-20.3.10.4.7.2 Functional Processing.- The **WW** groups shall be recognized by detection of the entire header. Individual **WW** messages shall be detected by recognizing text on a new line following the header. Each new **WW** message shall be placed with the third line of the header into an associated data element, if one has been defined, whose data element name is the **WW** message number, and whose expiration time is until canceled. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

Each **WW** amendment message with the last line of its header shall be appended to the original **WW** message with the same **WW** message number, if a data element with the same **WW** message number exists. If a data element with the same **WW** message number does not exist, or if the length of the original and appended messages exceeds the length of the data element, the combined message shall be sent to the Service A edit console.

If a **WW** cancel message is received, the associated data element containing a **WW** message with the same **WW** message number as that of the cancel message shall be removed from the data base. If no **WW** message data element has been defined, or if no defined **WW** message data element contains the same **WW** message numbers as that of the cancel message, the cancel message shall be sent to the Service A edit console.

1-20.3.10.4.7.3 External Outputs

       Data elements specified as being set in the functional-processing section.
       WW messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.7.4 Error **Processing.-** If a message fails to conform to the specified input format, if a duplicate **WW** message number exists, if an amendment or-cancel massage has no corresponding original message, or if the length of a field exceeds the length of the data element into which it

Each **WH** group contains one message beginning on the line following the last line of the header.

A **WH** message is canceled by transmission of the header described above and the words CANCEL or **CNCL** in the first line of the message.

WH message groups are input from the Service A line directly. Individual **WH** messages are also received from the edit and correction procedure.

1-20.3.10.4.8.2 Functional Processing.- The **WH** groups shall be recognized by detection of the entire header. Individual **WH** messages shall be detected by recognizing text on a new line following the header. Each **WH** message with the last line of the header shall be placed into the **WH** data element, if it has been defined, whose expiration time is until canceled. If an old **WH** message is residing in the **WH** data element when a new **WH** message is received, the new message shall replace the old one. If no data element has been defined, the message shall be discarded.

If a **WH** cancel message is received, and the **WH** data element contains a **WH** message, the WA message shall be removed from the data base.

1-20.3.10.4.8.3 External Outputs

        Data elements specified as being set in the functional processing
        section.
        WH messages to the Service A edit console with an indication of the
        location of the discrepancy.,

1-20.3.10.4.8.4 Error Processing.- If a message fails to conform to the specified input format, if the length of a field exceeds the length of the data element into which it is to be placed , or if a **WH** cancel message is received and no **WH** message is currently being stored in the data base, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed into data elements.

1-20.3.10.4.8.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly

processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

    (a) Origin: Only the origin MIA shall be accepted. At least one valid origin not of interest shall be rejected and sent to the edit console.

    (b) Cancellation: A valid cancellation message for an existing **WH** message shall be accepted and cancellation of the message shall be demonstrated. A valid cancellation message for a non-existant **WH** message shall be rejected and sent to the edit console.

1-20.3.10.4.9 Procedure 9 - WS, UWS, WA, and WAC Group Processing

1-20.3.10.4.9.1 External Inputs.- The **WS, UWS,** WA, and WAC group process shall accept for processing **WS, UWS,** WA, and WAC message groups with the following three line header:

    nnn
    (text)
    ooo WS dtg

or

    ooo UWS dtg

or

    ooo WA **dtg**

or

    ooo WAC **dtg**

where:

    nnn is the **WMSC** message number
    (text) is an optional user specified text
    ooo is the message origin
    dtg is the date time group

processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

    (a) Origin: Only the origin MIA shall be accepted. At least one valid origin not of interest shall be rejected and sent to the edit console.

    (b) Cancellation: A valid cancellation message for an existing **WH** message shall be accepted and cancellation of the message shall be demonstrated. A valid cancellation message for a non-existant **WH** message shall be rejected and sent to the edit console.

1-20.3.10.4.9 Procedure 9 **— WS, UWS,** WA, and WAC Group Processing

1-20.3.10.4.9.1 External Inputs.- The **WS, UWS,** WA, and WAC group process shall accept for processing **WS, UWS,** WA, and WAC message groups with the following three line header:

    nnn
    (text)
    ooo WS dtg

or

    ooo UWS dtg

or

    ooo WA **dtg**

or

    ooo WAC **dtg**

where:

    nnn is the **WMSC** message number
    (text) is an optional user specified text
    ooo is the message origin
    dtg is the date time group

WS, UWS, WA, and WAC message groups are input from the Service A line
directly. Individual messages from these groups are also received from the
edit and correction procedure.

1-20.3.10.4.9.2 Functional **Processing.-** The **WS, UWS,** WA, and WAC groups
shall be recognized by detection of the entire header. Individual messages
shall be detected by recognizing the validity time fields starting on a new
line. If a message did not come from an origin of interest, or if the time
the message was received is past the validity time plus an adaptation
parameter, the message shall be discarded.

Otherwise, each new message and the last line of the header shall be placed
into an associated data element, if one has been defined, which is uniquely
identified in its name using the origin, type, and phonetic alphabet of the
message, and whose expiration time Is either the valid until time plus an
adaptation parameter, or until canceled. If an associated data element has
not been defined, the message shall be discarded. If the length of the
message exceeds the length of the data element, the message shall be sent
to the Service A edit console.

If a message is received **with** the same origin, type, and phonetic alphabet
as a previous message, but with a number higher by one or the letters **COR**
following the same number as a message already in a data element, the
earlier message shall be replaced by the later message with the last line
of the header, and the validity time shall be updated, if necessary.
Otherwise, the later message with the same origin, type, and phonetic
alphabet as a previous message shall be sent to the Service A edit console.

If a cancellation message is received from an origin of interest, the
message with the same origin, type, phonetic alphabet, and number as those
in the cancellation message shall be removed from the data base.

1-20.3.10.4.9.3 External Outputs

> Data elements specified as being set in the functional processing
> section.
> **WS, UWS,** WA, and WAC messages to the Service A edit console with an
> indication of the location of the discrepancy.

1-20.3.10.4.9.4 Error Processing.- A message shall be discarded for any of
the following reasons:

The message did not come from an origin of interest.
The time the message was received was past the valid until time plus
an adaptation parameter.
An associated data element for a message has not been defined.

A message shall be sent to the edit console with an indication of the
location of the discrepancy and no fields from the message shall be placed
into data elements, for any of the following reasons:

The message fails to conform to the specified format.
The length of the message exceeds the length of the data element
into which it is to be placed.
The number of the first message received with a particular origin,
type, and phonetic alphabet is not **1.**
The number of the message is not one greater than the number of a
message currently stored with the same origin, type, and phonetic
alphabet.
The letters **COR** follow a number of a message without a corresponding
message currently stored with the same origin, type, phonetic
alphabet, and number.
A message is received with the same origin, type, phonetic alphabet,
and number as a message currently stored, but without the letter **COR**
following the number of the message just received.
A cancellation message is received for which there is no message
with the same origin, type, phonetic alphabet, and number currently
stored.

1-20.3.10.4.9.5 Quality Assurance Provisions.- The acceptance testing is
intended to demonstrate that status type fields are correctly processed for
all values, that both presence and absence of optional fields are correctly
processed and that field size constraints are correctly applied. These
guidelines are elaborated for specific fields below. Acceptance of all
valid field termination values and rejection of at least one invalid field
termination value shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest (if
there are at least three) shall be accepted. At least one valid
origin not of interest shall be rejected. It shall be demonstrated
that an invalid origin causes an edit alert and a valid origin not
of interest does not. Origins that are too short, too long, or
terminated by a character other than a space shall be rejected.

The message did not come from an origin of interest.
The time the message was received was past the valid until time plus
an adaptation parameter.
An associated data element for a message has not been defined.

A message shall be sent to the edit console with an indication of the
location of the discrepancy and no fields from the message shall be placed
into data elements, for any of the following reasons:

The message fails to conform to the specified format.
The length of the message exceeds the length of the data element
into which it is to be placed.
The number of the first message received with a particular origin,
type, and phonetic alphabet is not **1.**
The number of the message is not one greater than the number of a
message currently stored with the same origin, type, and phonetic
alphabet.
The letters **COR** follow a number of a message without a corresponding
message currently stored with the same origin, type, phonetic
alphabet, and number.
A message is received with the same origin, type, phonetic alphabet,
and number as a message currently stored, but without the letter **COR**
following the number of the message just received.
A cancellation message is received for which there is no message
with the same origin, type, phonetic alphabet, and number currently
stored.

1-20.3.10.4.9.5 Quality Assurance Provisions.- The acceptance testing is
intended to demonstrate that status type fields are correctly processed for
all values, that both presence and absence of optional fields are correctly
processed and that field size constraints are correctly applied. These
guidelines are elaborated for specific fields below. Acceptance of all
valid field termination values and rejection of at least one invalid field
termination value shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest (if
there are at least three) shall be accepted. At least one valid
origin not of interest shall be rejected. It shall be demonstrated
that an invalid origin causes an edit alert and a valid origin not
of interest does not. Origins that are too short, too long, or
terminated by a character other than a space shall be rejected.

The end of message is either the end of the group, or the beginning of the next message on a new line starting with:

        CONVECTIVE SIGMET number r

All messages in the same group have the same origin designator of C, E, or W.

WST message groups are input from the Service A line directly, Individual WST messages are also received from the edit and correction procedure.

1-20.3.10.4.10.2 Functional Processing.- The WST groups shall be recognized by detection of the entire header. Individual WST messages shall be detected by the third line of the header, or by a similar line without the origin field.

Each message, together with the third line of the header, shall be placed into an associated data element, if one has been defined, identified by the convective SIGMET number, whose expiration time is until canceled. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

When a cancel message is received, the convective SIGMET currently stored with the same origin and number shall be removed from the data base.

When a group is received for which there is no convective SIGMET, the entire group shall be discarded.

1-20.3.10.4.10.3 External Output

        Data elements specified as being set in the functional processing
        section.
        WST messages to the Service A edit console with an indication of the
        location of the discrepancy.

1-20.3.10.4.10.4 Error **Processing.**- A message shall be sent to the edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed into data elements, for any of the following reasons:

        The message fails to conform to the specified format.
        The length of the message exceeds the length of the data element
        into which it is to be placed.

A WST message is received with the same origin and number as a WST message currently stored.
A WST cancel message is received for which no WST message with the same origin and number is currently stored.

1-20.3.10.4.10.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejections of at least one invalid field termination value shall be demonstrated for each field processed.

(a) Origin: Acceptance of the three valid origins, and rejection of invalid origins consisting of an invalid alphabetic character, a numeric character, and two valid characters shall be demonstrated.

(b) Number: Acceptance of 1, 10, and 999, and rejection of 0, -1, 1000, and a field with a non-numeric character shall be demonstrated.

1-20.3.10.4.11 Procedure 11 - FA Group Processing

1-20.3.10.4.11.1 External Inputs.- The FA group process shall accept for processing FA message groups with the following two line header:

        nnn
        ooo FA dtg

where:

        nnn is the WMSC message number
        ooo is the message origin
        dtg is the date time group

The FA message follows the header beginning on a new line, and ending with the end of the message group.

An FA message is amended or corrected by transmission of a header whose second line has the following format:

        ooo FA AMD dtg

or

        000 FA COR dtg

where ooo and dtg are as defined above.

A **WST** message is received with the same origin and number as a **WST** message currently stored.
A **WST** cancel message is received for which no **WST** message with the same origin and number is currently stored.

1-20.3.10.4.10.5 <u>Quality Assurance Provisions.</u>- The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejections of at least one invalid field termination value shall be demonstrated for each field processed.

(a) Origin: Acceptance of the three valid origins, and rejection of invalid origins consisting of an invalid alphabetic character, a numeric character, and two valid characters shall be demonstrated.

(b) Number: Acceptance of **1, 10,** and **999,** and rejection of **0, -1, 1000,** and a field with a non-numeric character shall be demonstrated.

1-20.3.10.4.11 <u>Procedure 11 - FA Group Processing</u>

1-20.3.10.4.11.1 <u>External Inputs.</u>- The **FA** group process shall accept for processing **FA** message groups with the following two line header:

    nnn
    ooo FA dtg

where:

    nnn is the **WMSC** message number
    ooo is the message origin
    dtg is the date time group

The **FA** message follows the header beginning on a new line, and ending with the end of the message group.

An **FA** message is amended or corrected by transmission of a header whose second line has the following format:

    ooo FA AMD dtg

or

    000 FA COR dtg

where **ooo** and **dtg** are as defined above.

(a) Origin: At least three different valid origins of interest (if there are at least three) shall be accepted, and at least one valid origin not of interest shall be rejected. It shall be demonstrated that an invalid origin causes an edit alert and the valid origin not of interest does not. Origins that are too short, too long, or terminated by a character other than a space shall be rejected.

(b) Time: Acceptance of messages with **0000, 0001, 2358,** and **2359** in the time subfield of the data time group shall be demonstrated. Rejection of non-numeric characters, **2400, 0060,** and **3000** shall be demonstrated.

1-20.3.10.4.12 Procedure **12 – FT** Group Processing

1-20.3.10.4.12.1 **External** Inputs.- The **FT** group process shall accept for processing **FT** message groups with the following three to five line header:

> **nnn**
> (text)
> **FTUS1 KNKA dtg**
> **(ooo FT)**
> **ooo dtg** message text

or

> **ooo FT AMD** number **dtg** message text

or

> **ooo AMD** number **dtg** message text

or

> **ooo AMD dtg** message text

or

> **ooo FT COR dtg** message text

or

> **ooo FT RTD dtg** message text

where:

(a) Origin: At least three different valid origins of interest (if there are at least three) shall be accepted, and at least one valid origin not of interest shall be rejected. It shall be demonstrated that an invalid origin causes an edit alert and the valid origin not of interest does not. Origins that are too short, too long, or terminated by a character other than a space shall be rejected.

(b) Time: Acceptance of messages with **0000, 0001, 2358,** and **2359** in the time subfield of the data time group shall be demonstrated. Rejection of non-numeric characters, **2400, 0060,** and **3000** shall be demonstrated.

1-20.3.10.4.12 Procedure **12 – FT** Group Processing

1-20.3.10.4.12.1 **External** Inputs.- The **FT** group process shall accept for processing **FT** message groups with the following three to five line header:

nnn
(text)
FTUS1 KNKA dtg
(ooo FT)
ooo dtg message text

or

ooo FT AMD number **dtg** message text

or

ooo AMD number **dtg** message text

or

ooo AMD dtg message text

or

ooo FT COR dtg message text

or

ooo FT RTD dtg message text

where:

processed and that field size constraints are correctly applied. These
guidelines are elaborated for specific fields below. Acceptance of all
valid field termination values and rejection of at least one invalid field
termination value shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest (if
there are at least three) shall be accepted. At least one valid
origin not of interest shall be rejected. It shall be demonstrated
that an invalid origin causes an edit alert and the valid origin not
of interest causes an edit alert and the valid origin not of
interest does not. Origins that are too short, too long, or
terminated by a character other than a space shall be rejected.

(b) Time: Time subfields within the date time group with 0000,
0001, 2358, and 2359 shall be accepted. Time subfields with
non-numeric characters, 2400, 0060, and 3000 shall be demonstrated.

1-20.3.10.4.13 Procedure 13 - FD Group Processing,

1-20.3.10.4.13.1 External Inputs.- The FD group process shall accept for
processing FD message groups with the following six line header:

```
nnn
(text)
FDn KNKA dtg
DATA BASED ON dtgZ
VALID dtgZ FOR USE tg-tgZ TEMPS NEG ABV 24000
FT 3000 6000 9000 12000 18000 24000 30000 34000 39000
```

where:

nnn is the WMSC messge number
(text) is an optional user specified text
n is 1, 2, or 3
dtg is the date time group
tg is the time group

The next line contains an FD message and begins with a three character
origin. Each FD message takes up only one line.

FD message groups are input from the Service A line directly. Individual
FD messages are also received from the edit and correction procedure.

1-20.3.10.4.13.2 Functional **Processing.-** The **FD** groups shall be recognized by detection of the entire header. Individual **FD** messages shall be detected by recognizing the origin at the beginning of a new line. **FD1, FD2,** and **FD3** messages are processed as if they are separate message types.

If the message did not come from an origin of interest, or the message expiration time has already passed, the message shall be discarded. Otherwise, each message and the last three lines of the header shall be placed into as associated data element, if one has been defined, and shall replace the message currently stored in that data element, if any. The data element shall be identified by the origin, and shall have an expiration time of the end of the validity period plus an adaptation parameter. At the expiration time, the message shall be removed from the data base. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.13.3 External Outputs

> Data elements specified as being set in the functional processing s e c t i o n .
> **FD** messages to the Service A edit console with an indication of the location of discrepancy.

1-20.3.10.4.13.4 Error **Processing.-** If a message that is determined to be for an origin of interest for this site fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed into data elements.

1-20.3.10.4.13.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

> (a) Origin: At least three different valid origins of interest (if there are at least three) shall be accepted. At least one valid origin not of interest shall be rejected. It shall be demonstrated

1-20.3.10.4.13.2 Functional **Processing.-** The **FD** groups shall be recognized by detection of the entire header. Individual **FD** messages shall be detected by recognizing the origin at the beginning of a new line. **FD1, FD2,** and **FD3** messages are processed as if they are separate message types.

If the message did not come from an origin of interest, or the message expiration time has already passed, the message shall be discarded. Otherwise, each message and the last three lines of the header shall be placed into as associated data element, if one has been defined, and shall replace the message currently stored in that data element, if any. The data element shall be identified by the origin, and shall have an expiration time of the end of the validity period plus an adaptation parameter. At the expiration time, the message shall be removed from the data base. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.13.3 External Outputs

> Data elements specified as being set in the functional processing
> s e c t i o n .
> **FD** messages to the Service A edit console with an indication of the
> location of discrepancy.

1-20.3.10.4.13.4 Error **Processing.-** If a message that is determined to be for an origin of interest for this site fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed into data elements.

1-20.3.10.4.13.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

> (a) Origin: At least three different valid origins of interest (if
> there are at least three) shall be accepted. At least one valid
> origin not of interest shall be rejected. It shall be demonstrated

there is currently stored on older message with the same origin, the newer
message shall replace the older one. If an associated data element has not
been defined, the message shall be discarded. If the length of the message
exceeds the length of the data element, the message shall be sent to the
Service A edit console.

1-20.3.10.4.14.3 External Outputs

Data elements specified as being set in the functional processing
section.
SD messages to the Service A edit console with an indication of the
location of the discrepancy.

1-20.3.10.4.14.4 Error **Processing.-** If a message that is determined to be
for an origin of interest for this site fails to conform to the specified
input format, or if the length of a field exceeds the length of the data
element into which it is to be placed, the message shall be sent to the
Service A edit console with an indication of the location of the
discrepancy, and no fields from the message shall be placed in data
elements.

1-20.3.10.4.14.5 Quality Assurance Provisions.- The acceptance testing is
intended to demonstrate that status fields are correctly processed for all
values, that both presence and absence of optional fields are correctly
processed and that field size constraints are correctly applied. These
guidelines are elaborated for specific fields below. Acceptance of all
valid field termination values and rejection of at least one invalid field
termination value shall be demonstrated for each field processed.

(a) Origin: At least three different valid origins of interest (if
there are at least three) shall be accepted. At least one valid
origin not of interest shall be rejected. It shall be demonstrated
that an invalid origin causes an edit alert and the valid origin not
of interest does not. Origins that are too short, too long, or
terminated by a character other than a space shall be rejected.

(b) Time: Acceptance of messages with **0000, 0001, 2358** and **2359**
shall be demonstrated. Rejection of non-numeric characters, **2400,
0060,** and **3000** shall be demonstrated.

1-20.3.10.4.15 Procedure 15 - TWEB/SYNS Group Processing

1-20.3.10.4.15.1 External Inputs.- The TWEB and SYNS group processes shall accept for processing TWEB and SYNS message groups with the following three line header:

     nnn
     (text)
     rrr TWEB dtg TWEB message text

or

     rrr TWEB RTD dtg TWEB message text

or

     rrr TWEB AMD dtg TWEB message text

or

     ooo SYNS dtg SYNS message text

or

     ooo SYNS RTD dtg SYNS message text

or

     ooo SYNS AMD dtg SYNS message text

where:

     nnn is the WMSC message number
     (text) is the optional user specified text
     rrr is a TWEB route number
     dtg is the date time group
     ooo is a TWEB SYNS origin

An end of message is detected by the beginning of a new message or the end of the message group. TWEB and SYNS message groups are input from the Service A line directly. Individual TWEB and SYNS messages are also received from the edit and correction procedure.

1-20.3.10.4.15 Procedure 15 - TWEB/SYNS Group Processing

1-20.3.10.4.15.1 External Inputs.- The TWEB and SYNS group processes shall accept for processing TWEB and SYNS message groups with the following three line header:

        nnn
        (text)
        rrr TWEB dtg TWEB message text

or

        rrr TWEB RTD dtg TWEB message text

or

        rrr TWEB AMD dtg TWEB message text

or

        ooo SYNS dtg SYNS message text

or

        ooo SYNS RTD dtg SYNS message text

or

        ooo SYNS AMD dtg SYNS message text

where:

        nnn is the WMSC message number
        (text) is the optional user specified text
        rrr is a TWEB route number
        dtg is the date time group
        ooo is a TWEB SYNS origin

An end of message is detected by the beginning of a new message or the end of the message group. TWEB and SYNS message groups are input from the Service A line directly. Individual TWEB and SYNS messages are also received from the edit and correction procedure.

be demonstrated that an invalid origin causes an edit alert and the valid origin not of interest does not. Origins that are too short, too long, or terminated by a character other than a space shall be rejected.

(b) Time: Acceptance of messages with **0000, 0001, 2358,** and **2359** shall be demonstrated. Rejection of non-numeric characters, **2400, 0060,** and **3000** shall be demonstrated.

1-20.3.10.4.16 Procedure **16 - WO** Group Processing

1-20.3.10.4.16.1 External Inputs.- The **WO** group process shall accept for processing **WO** groups with the following three line header:

> **nnn**
> (text)
> message identifier

where;

> **nnn** is the **WMSC** message number
> (text) is the optional user specified text
> message identifier is one of the following:

> **WOCAln KMIA**
> **WOCAln MJSJ**
> **WONTln KBOS**
> **WONTln KDCA**
> **WOPNln KSFO**
> **WOPNln PHNL**
> **WOHWm   PHNL**
> **WOHWp   PHLI**
> **WOHWp   PHOG**
> **WOHWp   PHTO**
> **WOPA   PHNL**
> **WOPN   PHNL**
> **WOPS   NFFN**
> **WOPS   PHNL**
> **WOUS1   KAWN**

where:

> **n** = 1 - **5**
> **m** = 1 - **3**
> p = 2 - **3**

The **WO** text follows the header starting on a new line and ends with the end of message group. **WO** message groups are input from the Service A line directly. Individual **WO** messages are also received from the edit and correction procedure.

1-20.3.10.4.16.2 Functional Processing.- The **WO** groups shall be recognized by detection of the entire header. Individual **WO** messages shall be detected by recognizing the text of the message starting on a new line after the header.

Each message shall be placed into an associated data element, if one has been defined, identified by the message identifier, and whose expiration time is until replaced. If a new message is received for which there is currently stored an older message with the same message identifier, the newer message shall replace the older one. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.16.3 External Outputs

> Data elements specified as being set in the functional processing section.
> **WO** messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.16.4 Error Processing.- If a **WO** message header has an illegal message identifier or the header or message fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.16.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields **below.** Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

In particular, all message valid identifiers shall be accepted, and message identifiers with illegal n, m, or p values, illegal two or three letter subfields **following** the **WO,** and illegal four letter groups in the last field shall be rejected.

The **WO** text follows the header starting on a new line and ends with the end of message group. **WO** message groups are input from the Service A line directly.   Individual **WO** messages are also received from the edit and correction procedure.

1-20.3.10.4.16.2 Functional Processing.- The **WO** groups shall be recognized by detection of the entire header.   Individual **WO** messages shall be detected by recognizing the text of the message starting on a new line after the header.

Each message shall be placed into an associated data element, if one has been defined, identified by the message identifier, and whose expiration time is until replaced.   If a new message is received for which there is currently stored an older message with the same message identifier, the newer message shall replace the older one.   If an associated data element has not been defined, the message shall be discarded.   If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.16.3 External Outputs

> Data elements specified as being set in the functional processing section.
> **WO** messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.16.4 Error Processing.- If a **WO** message header has an illegal message identifier or the header or message fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.16.5 Quality Assurance **Provisions.-** The acceptance testing is intended to demonstrate that status type fields are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields **below.** Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

In particular, all message valid identifiers shall be accepted, and message identifiers with illegal n, m, or p values, illegal two or three letter subfields **following** the **WO,** and illegal four letter groups in the last field shall be rejected.

1-20.3.10.4.17.2 Functional **Processing.-** The **FX** groups shall be recognized by detection of the entire header. Individual **FX** messages shall be detected by recognizing the text of the message starting on a new line after the header.

Each message shall be placed into an **associated** data element, if one has been defined, identified by the message identifier, and whose expiration time is until replaced. If new message is received for which there is currently stored an older message with the same message identifier, the newer message shall replace the older one. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.17.3 External Outputs

Data elements specified as being set in the functional processing section.
FX messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.17.4 Error **Processing.-** If a **FX** message header has an illegal message **identifer** or the header of message fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.17.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that status type **fields** are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

In particular, all valid message identifiers shall be accepted, and at least one invalid message identifier shall be rejected.

1-20.3 10.4.18 Procedure 18 - Message Editing and Correction

1-20.3 10.4.18.1 External **Inputs.-** The message editing process shall accept the following inputs from the Service A group processes:

1-20.3.10.4.17.2 Functional **Processing.-** The **FX** groups shall be recognized by detection of the entire header. Individual **FX** messages shall be detected by recognizing the text of the message starting on a new line after the header.

Each message shall be placed into an **associated** data element, if one has been defined, identified by the message identifier, and whose expiration time is until replaced. If new message is received for which there is currently stored an older message with the same message identifier, the newer message shall replace the older one. If an associated data element has not been defined, the message shall be discarded. If the length of the message exceeds the length of the data element, the message shall be sent to the Service A edit console.

1-20.3.10.4.17.3 External Outputs

Data elements specified as being set in the functional processing section.
FX messages to the Service A edit console with an indication of the location of the discrepancy.

1-20.3.10.4.17.4 Error **Processing.-** If a **FX** message header has an illegal message **identifer** or the header of message fails to conform to the specified input format, or if the length of a field exceeds the length of the data element into which it is to be placed, the message shall be sent to the Service A edit console with an indication of the location of the discrepancy, and no fields from the message shall be placed in data elements.

1-20.3.10.4.17.5 Quality Assurance Provisions.- The acceptance testing is intended to demonstrate that status type **fields** are correctly processed for all values, that both presence and absence of optional fields are correctly processed and that field size constraints are correctly applied. These guidelines are elaborated for specific fields below. Acceptance of all valid field termination values and rejection of at least one invalid field termination value shall be demonstrated for each field processed.

In particular, all valid message identifiers shall be accepted, and at least one invalid message identifier shall be rejected.

1-20.3 10.4.18 Procedure 18 - Message Editing and Correction

1-20.3 10.4.18.1 External **Inputs.-** The message editing process shall accept the following inputs from the Service A group processes:

If the operator enters the ❯ EA command followed by the corrected message,
that message will be rerouted to the originating Service A process and
deleted from the edit queue.

If the operator enters the > XA command, the message shall be discarded.

When the Service A message queue becomes empty, the Service A alarm shall
be removed from the Service A console alarm area.

If the operator enters the > QA command, the message shall be placed in the
queue at the back.

If the operator enters the ❯ LA command, the previous message shall be
displayed for editing or other command processing in the same format as the
❯ NA command.

1-20.3.10.4.18.3 External Outputs

Corrected messages to appropriate Service A process.
Displayable messages to the Service A edit console as described in
the functional processing section.
Service A message alarm to the Service A edit console alarm area.
Deletion of Service A message alarm from the Service A edit console
alarm area.

1-20.3.10.4.18.4 Error Processing.- If there is not room in the queue for
a message received from a Service A group process, an alarm will be output
to the Service A edit console and the new message shall be discarded.

Any attempt to acknowledge a Service A alarm (❯ DA, A) or to request the
next message (NA) when the queue is empty or the last message when none is
available, will result in the display of the message "NONE".

Any attempt to delete a message from the queue that is not the most
recently displayed message or to act on a non-existent message shall result
in the response "THIS MESSAGE NOT AVAILABLE."

1-20.3.10.4.18.5 Quality Assurance Provisions.- Output of the alarm when
one or more than one message are placed in the queue shall be demonstrated.
Retention of the alarm until the last message in the queue is discarded
(❯ XA) and until the last message in the queue is edited (❯ EA) shall be
demonstrated. Retention of the alarm when the last message in the queue is
queued (❯ QA) shall be demonstrated.

TABLE 1-20-4

SUMMARY OF COMMAND SEQUENCES

Previous			Present	Command	
Command	**NA**	LA	**XA***	**EA***	**QA***
NA or DA, A	N	L	N	E	N
LA	N	L	I	E	L
XA	N	L	I	E	L
EA	N	L	I	E	L
QA	N	L	I	E	L

N = Action performed on message at front of queue.
L = Action performed on message in last message memory.
E = Action performed on edited message.
I = Invalid sequence

* These actions remove the message from the front of the queue and place it
in last message memory.

TABLE 1-20-4

SUMMARY OF COMMAND SEQUENCES

Previous			Present Command		
Command	**NA**	LA	**XA***	**EA***	QA*
NA or DA, A	N	L	N	E	N
LA	N	L	I	E	L
XA	N	L	I	E	L
EA	N	L	I	E	L
QA	N	L	I	E	L

N = Action performed on message at front of queue.
L = Action performed on message in last message memory.
E = Action performed on edited message.
I = Invalid sequence

* These actions remove the message from the front of the queue and place it in last message memory.

(b) 'software' control, via the maintenance, Cab, and **TRACON SMDs** operating at level 1 access protection, of the following devices:

ILS
ALS
SFL
MATS
VASI
Runway edge lights
Runway center line lights
REIL
Engine generator

(c) Specification of the commands and the command messages.

1-20.3.11.2 System Components Required.- **CPS,** Cab **SMD, TRACON SMD,** Maintenance **SMD, LCP,** and **FPU** (test device).

1-20.3.11.3 Other Demonstrable Units Required.- **DU1, DU2, DU3, DU4, DU5, DU6,** and **DU7.**

1-20.3.11.4 Function 1 - Control Lights.- For each runway assigned to him, the tower cab controller may select a light level for **ALS, SFL, VASI,** runway edge lights, runway centerline lights , and **REIL,** or he may turn them off, using control buttons located at his position. This function is supported by the function described in Section **1-20.3.11.5** and by the **proecedure** described below.

The layout of the tower cab light control panel is shown in Figure **1-20-5.** Row 1 contains indicators in columns **1, 3,** and 5 whose legends indicate the runways assigned to the tower cab position. These legends are controlled by the **CPS** during configuration processing.

Rows **2-5** in columns **1-6** contain a push button which activates a momentary contact switch for each lighting system for each assigned runway. Each push button switch assembly contains and indicator, similar to the assigned runway indicators, with legends indicating the lighting system being controlled and its current level of intensity. A blank legend indicates the assigned runway does not have the lighting device which that button normally controls. For example, runway **12L** has no **REIL** and runway **23R** has no **VASI.** Row 6 provides control of light intensity levels using the same kind of push button switch assemblies as in rows **2-5,** except with fixed legends.

FIGURE 1-20-5

LIGHTING CONTROL PANEL LAYOUT

Columns

	1	2	3	4	5	6

Rows

12L		23R		09L	
ALS	SEQ FL	MAL	EQ **FL**	ALS	SEQ F L
4	ON	3	OFF	2	OFF
RWY		RWY		RWY	
3		2		2	
CL		CL		CL	
3		2		2	
VASI			REIL	VASI	REIL
1			ON	1	ON

6	OFF	1	2	3	4	5	TEST

FIGURE 1-20-5

LIGHTING CONTROL PANEL LAYOUT

Columns

	1	2	3	4	5	6

Rows

12L		23R		09L	
ALS	SEQ FL	MAL	EQ **FL**	ALS	SEQ F L
4	**ON**	**3**	**OFF**	**2**	**OFF**
RWY		RWY		RWY	
3		**2**		**2**	
CL		**CL**		CL	
3		**2**		2	
VASI			REIL	VASI	REIL
1			**ON**	1	ON

6	**OFF**	1	2	3	4	5	**TEST**

1-20.3.11.4.1.5 Quality Assurance Provisions.- All the tower cab buttons related to device control shall be activated in different sequences to assure that the proper messages are sent to the appropriate devices.

1-20.3.11.5 Function 2 - Device Control.- From any **SMD,** a user with level 1 access shall have the capability to control the devices listed in Section **1-20.3.11.1(b)** above, by entertaining the appropriate command. This function shall be supported by the procedures described below.

1-20.3.11.5.1 Procedure 1 - Specify **Control.-** Device control messages and commands shall be defined by the list **SYS:CONTROL** the format of which message, [NAME = switch], [MASTER = device] where 'device mnemonic' is a user defined ASCII name 1 to **20** characters long for the device to be controlled e.g., **ALS19R** (the approach lights to runway **19R).** Keyword parameters shall be defined as follows: ADDRESS is a multiplexer device code and the MUX channel number of the communication port to the lighting system **FPU.**

MSG is a group of any length of characters (codes) specifying the control to be performed.

NAME is an optional parameter consisting of an ASCII name 1 to **20** characters long which specifies a switch subparameter for the specified device. An example would be NAME = ON, which assigns the switch value ON to **MSG** (see Section **1-20.3.11.5.2).**

MASTER is an optional parameter consisting of an ASCII name 1 to 8 characters long which specifies the control lockout procedure (see Section **1-20.3.11.5.2).**

The list specified above is built by the user via the modify list (ML) command, which is described in Section **1-20.3.3.4.**

1-20.3.11.5.1.1 External Inputs.- Modify List (ML) commands from a **SMD.**

1-20.3.11.5.1.2 Functional Processing.- Special purpose software, referred to as **CHECKC,** shall perform error checking as described below.   \

1-20.3.11.5.1.3 External **Outputs.-** An updated device list shall be outputted to disk.

1-20.3.11.5.1.4 Error **Processing.-** User input shall be checked for duplicate definitions, where a duplicate definition shall be defined as **two** list entries with the same device mnemonics and the same NAME keyword value. If this error is detected the message:

CONTROL DEFINITION **ERROR:DUPLICATE** LIST ENTRY

shall be displayed and processing of that entry shall be terminated without generating the duplicate entry in the list.

1-20.3.11.5.1.5 Quality Assurance Provisions.- This procedure shall be tested by entering valid and invalid command data. The duplicate entry error check shall be exercised and the results verified by displaying the list.

1-20.3.11.5.2 Procedure 2 - Control Device

1-20.3.11.5.2.1 External **Inputs.-** The control device command shall have the following format.

CD, device mnemonic, [control mnemonic], [UNLOCK]

where:

device mnemonic is as defined above
control mnemonic is the optional name specified by the NAME keyword
    in the control list
UNLOCK is a precedence reordering command

1-20.3.11.5.2.2 Functional **Processing.-** The message specified in the list of control command shall be sent to the address specified in the same list for the device and message corresponding to the entered device mnemonic and control mnemonic, and the control command and message shall be recorded. This shall occur only if the console originating the command has the highest priority, or if the MASTER console 'has unlocked the device.

1-20.3.11.5.2.3 External **Outputs.-** Message to external device, error messages to the **SMDs,** and control command and messages to the recording device.

1-20.3.11.5.2.4 Error **Processing.-** If an error occurs in sending the message to the device, the message:

1-20.3.11.5.1.4 Error **Processing.-** User input shall be checked for
duplicate definitions, where a duplicate definition shall be defined as **two**
list entries with the same device mnemonics and the same NAME keyword
value. If this error is detected the message:

> CONTROL DEFINITION **ERROR:DUPLICATE** LIST ENTRY

shall be displayed and processing of that entry shall be terminated without
generating the duplicate entry in the list.

1-20.3.11.5.1.5 Quality Assurance Provisions.- This procedure shall be
tested by entering valid and invalid command data. The duplicate entry
error check shall be exercised and the results verified by displaying the
list.

1-20.3.11.5.2 Procedure 2 - Control Device

1-20.3.11.5.2.1 External **Inputs.-** The control device command shall have
the following format.

> CD, device mnemonic, [control mnemonic], [UNLOCK]

where:

> device mnemonic is as defined above
> control mnemonic is the optional name specified by the NAME keyword
>   in the control list
> UNLOCK is a precedence reordering command

1-20.3.11.5.2.2 Functional **Processing.-** The message specified in the list
of control command shall be sent to the address specified in the same list
for the device and message corresponding to the entered device mnemonic and
control mnemonic, and the control command and message shall be recorded.
This shall occur only if the console originating the command has the
highest priority, or if the MASTER console 'has unlocked the device.

1-20.3.11.5.2.3 External **Outputs.-** Message to external device, error
messages to the **SMDs,** and control command and messages to the recording
device.

1-20.3.11.5.2.4 Error **Processing.-** If an error occurs in sending the
message to the device, the message:

<u>1-20.3.12.4.1 External Inputs</u>.- With the recording tape mounted and an **SMD** user logged on with level 1 access , the event reconstruction process shall prompt with the normal command prompt, and shall accept only the Initiate Reconstruction **(IR),** Halt Reconstruction **(HR),** Resume Reconstruction (RR), Print System State Snapshot (SS), and End Reconstruction **(ER)** commands. The syntax of these commands is as follows:

>**IR [,STARTT** = start time], **[STOPT** = stop time], **[STARTET –** state printout time **1,** state printout time **2,...], [,STATEI =** state printout interval **1,** state printout interval **2,...]**

>**HR**

>**RR[,STARTT** = start time] **[STOPT =** stop time] **[,STATET** = state printout time **1,** state print ut time **2,...] [.STATEI** = printout interval **1,** state printout interval **2,...]**

>**SS**

>**ER**

where:

> <u>start time</u> is the first recorded time tag for recorded data to be reported (optional).

> <u>stop time</u> is the last recorded time tag for recorded data to be reported (optional).

> <u>state printout time</u> is the time which, when a larger valued time tag less than or equal to the stop time is encountered, initiates printing of a system state summary (optional).

> <u>state printout interval</u> is the recorded time difference, in seconds, between the time tag initiating printing of the last system state summary and the time tag initiating printing of next system state summary (optional).

The format of all times shall be **hhmmss,** where **hh** represents a two digit hours field, mm represents a two digit minutes field, and **ss** represents a two digit seconds field. All times shall be taken as Greenwich Mean Time. For example, **134655** represents **13** hours, **46** minutes, and **55** seconds ZULU.

The event reconstruction prccess shall also accept input from the recording tape, whose format is described in Section 1-20.3.6.

1-20.3.12.4.2 Functional Processing.- Upon entry of a complete IR statement, if no tape is mounted, or the tape that is mounted is not a recorded tape, the message 'EVENT RECONSTRUCTION ERROR:RECORDING TAPE NOT MOUNTED' shall be displayed on the SMD. Otherwise, the system state snapshot at the start of the recording tape shall be read and stored. If no start time is specified in the IR command, the default value shall be the time in the time tag of he system state snapshot at the beginning of the tape.

Each system state snapshot or message that is encountered on the tape shall be processed into data elements, and the current values of these data elements shall be replaced by the new values. If a data element has not been defined for a particular piece of a system state snapshot or of a message, that piece of data shall be discarded.

When the start time is equal to or less than the time tag in a message encountered on the tape, a system state summary shall be printed on the hardcopy device, and all subsequent messages and system state snapshots encountered on the tape shall be printed until the end time is equal to or less than the time in a time tag in a message encountered on the tape. If no end time is specified in the IR command, the default value shall be the time in the time tag of the system state snapshot or the message at the end of the tape. After the final message or system state snapshot encountered on the tape is printed, the current reconstructed system state data elements shall be printed, followed by a new line with the message 'END OF EVENT RECONSTRUCTION FROM start time ZULU to stop time ZULU'.

In addition to printing the system state snapshots as then are encountered on the tape, the reconstructed system state data elements shall be printed:

        (a) whenever each optional state printout time, in sequence, is
        equal to or less than the time in a time tag in a message
        encountered on the tape,

        (b) every state printout interval 1, in seconds, since the last
        state printout was encountered, then each interval 2, etc., or

        (c) by entering an HR command followed by an SS command.

The event reconstruction process shall also accept input from the recording tape, whose format is described in Section 1-20.3.6.

1-20.3.12.4.2 Functional Processing.- Upon entry of a complete IR statement, if no tape is mounted, or the tape that is mounted is not a recorded tape, the message 'EVENT RECONSTRUCTION ERROR:RECORDING TAPE NOT MOUNTED' shall be displayed on the SMD. Otherwise, the system state snapshot at the start of the recording tape shall be read and stored. If no start time is specified in the IR command, the default value shall be the time in the time tag of he system state snapshot at the beginning of the tape.

Each system state snapshot or message that is encountered on the tape shall be processed into data elements, and the current values of these data elements shall be replaced by the new values. If a data element has not been defined for a particular piece of a system state snapshot or of a message, that piece of data shall be discarded.

When the start time is equal to or less than the time tag in a message encountered on the tape, a system state summary shall be printed on the hardcopy device, and all subsequent messages and system state snapshots encountered on the tape shall be printed until the end time is equal to or less than the time in a time tag in a message encountered on the tape. If no end time is specified in the IR command, the default value shall be the time in the time tag of the system state snapshot or the message at the end of the tape. After the final message or system state snapshot encountered on the tape is printed, the current reconstructed system state data elements shall be printed, followed by a new line with the message 'END OF EVENT RECONSTRUCTION FROM start time ZULU to stop time ZULU'.

In addition to printing the system state snapshots as then are encountered on the tape, the reconstructed system state data elements shall be printed:

(a) whenever each optional state printout time, in sequence, is equal to or less than the time in a time tag in a message encountered on the tape,

(b) every state printout interval 1, in seconds, since the last state printout was encountered, then each interval 2, etc., or

(c) by entering an HR command followed by an SS command.

'EVENT RECONSTRUCTION WARNING: DESIRED DATA ARE NOT ON THIS TAPE'

shall be displayed.

If the end of the recording tape is encountered before a message time tag greater than the stop time is encountered, then the tape is rewound, an **HR** command is automatically executed, and the message:

> **'EVENT** RECONSTRUCTION WARNING: END OF-DATA - MOUNT NEXT TAPE AND ENTER RR'

shall be displayed.

1-20.3.12.4.3 External Outputs.- Messages to the **SMD,** and formatted recording tape data and reconstructed system states to the line printer.

1-20.3.12.4.4 Error Processing.- If an error in command format occurs, such as too many parameters, misspelled keyword parameters, invalid time fields, or invalid interval fields, the message:

> 'EVENT RECONSTRUCTION **ERROR:INVALID** COMMAND FORMAT'

shall be displayed, then the command causing the error shall be redisplayed with the cursor over the character causing the error. The user may edit the command using the local console editing features, then resend the command.

If a command is entered out-of-sequence, that is,

> (a) **HR,** RR, **SS,** or **ER** is entered before **IR,**
> **(b)** RR or **SS** is entered after **IR** but before **HR,** or
> **(c)** **SS** is entered after **IR** and RR,

the command is ignored and the message:

> 'EVENT RECONSTRUCTION **ERROR:COMMAND** OUT-OF-SEQUENCE'

shall be displayed.

1-20.3.12.4.5 Quality Assurance Provisions.- This function shall be verified by processing a recording tape generated under **DU6.** Acceptance of valid time fields containing **000000** and **235959,** and rejection of time fields containing **240000, 006000,** and **300000** shall be demonstrated.

Acceptance of **IR, HR,** RR, **SS,** and **ER** commands without optional parameters, and rejection of **HR, SS,** and **ER** with at least one optional parameter shall be demonstrated. Acceptance of **IR** and RR commands with all combinations of optional keywords, and rejection of **IR** and RR commands with five keyword parameters, or with fewer than five parameters at least one of which is misspelled, shall be demonstrated.

Acceptance of **IR, HR,** RR, **SS,** and **ER** commands without optional parameters, and rejection of **HR, SS,** and **ER** with at least one optional parameter shall be demonstrated. Acceptance of **IR** and RR commands with all combinations of optional keywords, and rejection of **IR** and RR commands with five keyword parameters, or with fewer than five parameters at least one of which is misspelled, shall be demonstrated.

APPENDIX II - DATA BASE

The following shall define and specify the nomenclature and operational
characteristics of the Data Base. The Data Base shall contain sufficient
information to fully categorize and reconstruct the system state at the
time of Data Base dump. The primary Data Base medium shall be nonvolatile,
those Data Base Elements which must be resident in volatile storage for
procesing purposes shall be backed up to non-volatile storage at
(adaptation parameters) intervals.

The basic construct of the Data Base is the 'Family'. Families are groups
of Data Base Elements with common attributes or with logical associations.
A family may be either a Family of Lists or a Structured Family. A Family
of Lists is a Family all of whose members are List Data Elements.
A structured Family is one whose members are all Structured Data Elements.

A List Data Element is a variable length string, normally, but not
necessarily, consisting of ASCII characters. The basic subelement of a
List is a 'line' where a line is terminated by a carriage return (CR)
character. A List may be unformatted or may be in command input format.

A Structured Data Element may be a variable length string or a variable,
vector, or array of one of the following types:

> Signed integer
> Real
> Octal
> Hexadecimal
> Logical
> Binary

The Data Base shall be described by a Data Base Description consisting of
three parts:

> Family Descriptions
> List Descriptions
> Data Element Descriptions

These descriptions shall be maintained as Lists and shall be incorporated
into the Data Base. These lists shall belong to the system description
family **SYS** and shall be names:

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Listing of Parts:

FAA-ER-500-007/1   Part 1 - General;

FAA-ER-500-007/2   Part 2 - Display Subsystem

FAA-ER-500-700/3   Part 3 - Central Processing Subsystem

FAA-ER-500-700/4   Part 4 - Remote Transmitter/Receiver Subsystem

FAA-ER-500-700/5   Part 5 - Instrument Landing System Subsystem

FAA-ER-500-700/6   Part 6 - Lighting/RVR Subsystem

FAA-ER-500-700/7   Part 7 - Tower Interface Subsystem

2-1 SCOPE

2-1.1 Scope of Part 2.- This Part 2 contains the requirements which are applicable, alone or in conjunction with other parts of this Engineering Requirement, to the design, fabrication, testing, installation, and field validation of the display subsystem of a CCD/RMMS system to be installed and operated in FAA terminal facilities.

2-1.2 Applicable Definitions

2-1.3 Applicable Abbreviations.- Other abbreviations are defined in other parts of the ER.

CD   Critical Display

LCP   Lighting Control Panel

LLWSAS   Low Level Wind Shear Advisory System

SD   Supplementary Display

SMD   Supervisory/Maintenance Display

TD   TRACON Display

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FAA-ER-500-007/1   Part 1 - General;

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FAA-ER-500-700/4   Part 4 - Remote Transmitter/Receiver Subsystem

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In the tower cab there are a number of controller positions. Each shall contain a "critical display" which shall present data which must be available on a continuous basis due to frequency of reference or must be displayed instantaneously due to urgency. Also in the tower cab, colocated with the "critical display," shall be the "supplementary display." This display shall present noncritical data to the controller upon page request. Also, colocated with the "critical display" shall be the "lighting control panel." This shall allow the controller to control the various airport lighting systems intensity levels. There shall be a "supervisory/maintenance display" which shall present critical and supplementary data upon request and provide the capability to manually enter data for the display subsystem.

In the TRACON there shall be a number of combined displays, "TRACON displays," containing some of the data which is contained on the "critical displays" as well as the capability of simultaneously presenting noncritical data such as that presented on the "supplementary displays." There shall be a TRACON "supervisory/maintenance display" with the same display and functional capabilities as the tower cab "supervisory/maintenance display."

All the displays, display/terminals, and lighting control panels (equipment) in the display subsystem shall interface with the central processing subsystem (CPS) and be independently addressed. The CPS requirements are defined in Part 3 of this ER. The data to be displayed by the display subsystem equipment shall be inputted to the CPS from the remote maintenance monitoring subsystems (see Parts 4, 5, 6, and 7 of this ER) and by manual entry from the Cab and TRACON "supervisory/maintenance display." The CPS shall format this data into data pages and transmit these data pages to the appropriate displays and display/terminals.

2-3.2 General Requirements.- The requirements for hardware and performance listed in Appendix 1-2, Part 1, shall also apply. The hardware requirements listed below are additional to other listed performances, and identify either the specific type or brand of device or device part to be incorporated, or a type or equivalent type to be incorporated, where equivalency is indicated by performance detail, or any device meeting all other' requirements that meets the specific performance indicated. Where "brand name," or "brand name or equal" is specified, the main and salient characteristics are indicated, and no reduction in the performance characteristics for display devices. For each of the major display elements listed below, a set of performances are required at the different ambient light levels. The specific nature of certain requirements, when so

indicated, shall connote special attention to display legibility performance, for which the requirements must be met.   Consideration has already been **given** towards a degree of consolidation and interchangeability of devices, and any further commonality within the five device types, shall be restricted to the accomplishment of internal functions, as they may be required, to accomplish the specified requirements.

Any inoperative or malfunctioning equipment in the display subsystem shall not hinder or degrade the performance of any other equipment in the display subsystem.   The software shall be provided for the **CPS** to perform the functions and requirements of the display subsystem.

2-3.3 Equipment to be Furnished by the Contractor.- The contractor shall furnish the quantity of the displays, display/terminals, and lighting control panels required within the display subsystem as specified in the contract.   Any item or part **necessary** for proper operation of equipment in accordance with the requirements of this **ER,** shall be incorporated even though that item or **part may** not be specifically provided for or described herein.   All features required to meet performance requirements such as indicator lamps, overload protection devices, test points, switches, etc., shall be incorporated even though the feature may not be specifically provided for or described herein.   All necessary ports, hardware, receptacles, mating connectors, cabling (wiring), adaptors, etc., shall be provided.   The deliverable equipment and documentation shall be furnished in accordance with the contract schedule.

These subparagraphs contain the requirements for all displays and lighting control **panels** in the displays subsystem.

2-3.3.1 Critical Display

2-3.3.1.1 Performance **Requirements.-** These subparagraphs contain operational/performance requirements for the CD in the display subsystem. The critical display shall perform the functions defined in the following subparagraphs.

2-3.3.1.1.1 Continuous Display.- A fixed formatted data page (see Figure 2-1a) shall be displayed **continously,** containing the following parameters:

        (a) Time of day

        (b) Barometric pressure

        (c) Center field wind direction, speed, and gust speed

(d) Runway designation

(e) Vortex advisory system (VAS) separation distance for each runway assigned.

(f) Navaid equipment status when they are sensed to be out; ILS (GS, LOC, IM, MM, OM), VOR, etc., including backups if they exist.

(g) ALS/MALS (lighting system) when they are sensed to be out.

(h) Runway visual range (RVR) and supplementary data character. A maximum of three for each runway assigned.

(i) Boundary surface wind direction/speed (LLWSAS data)

(j) ATIS character

(k) Weather messages and time of entry of the message on the display.

2-3.3.1.1.2 Update Time.- Time shall be updated, independent of other data updated from the CPS, once a second.

2-3.3.1.1.3 Display Boundary Surface Wind.- A boundary surface wind directions and speed shall be displayed (blinking) automatically if the boundary surface wind deviates from the center field wind by an LLWSAS specified amount. The capability shall be provided to manually select a specific boundary location to be displayed.

2-3.3.1.1.4 Set RVR Alarm Limit.- The capability shall be provided to manually select an alarm limit for each of the three RVR's for each runway assigned.

2-3.3.1.1.5 Alarm Alert/Alarm Acknowledge.- When a parameter is in an alarm state, the parameter shall be displayed blinking and shall continue to blink until the alarm acknowledge button is depressed. An audible alarm shall sound.

2-3.3.1.1.6 Manual Request Logging.- The capability shall be provided in both the Critical Display and the CPS to log certain manual actions executed on the display at the CPS for future event reconstruction.

2-3.3.1.2 Hardware/Performance Requirements.- These subparagraphs contain hardware/performance requirements for the CD in the display subsystem.

(d) Runway designation

(e) Vortex advisory system (VAS) separation distance for each runway assigned.

(f) Navaid equipment status when they are sensed to be out; ILS (GS, LOC, IM, MM, OM), VOR, etc., including backups if they exist.

(g) ALS/MALS (lighting system) when they are sensed to be out.

(h) Runway visual range (RVR) and supplementary data character. A maximum of three for each runway assigned.

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2-3.3.1.2 Hardware/Performance Requirements.- These subparagraphs contain hardware/performance requirements for the CD in the display subsystem.

2-3.3.1.2.3.2 Manual Brightness **Control.-** A brightness control shall manually change the brightness of the indicators. Its operation shall be in parallel with the automatic operation such that, manually the brightness can be reduced to a minimum of 10 percent of maximum, or manually the brightness can be increased to 80 percent of maximum brightness, or the manual operation can be switched out by a switch on the manual control. At no position shall the indicators be less than 10 percent "on," nor shall they be above 80 percent "on" under manual control.

2-3.3.1.2.4 Test **Button.-** A momentary action push switch shall provide the "test" function, described below.

2-3.3.1.2.5 Acknowledge **Button.-** A momentary action illuminated push button switch shall provide the "acknowledge" function to the **CPS.**

2-3.3.1.2.6 LLWSAS **Buttons.-** Two **LLWSAS** buttons shall be provided to manually force up on the display the **LLWSAS** values. They shall operate as push-on, push-off switches, and shall be illuminated when pushed to choose the automatic wind shear alarm mode of displayed information under **CPS** control. They shall show no illumination when pushed to manually force up remote wind information. Each button shall operate on the wind information in the line adjacent to the button.

2-3.3.1.2.7 RVR Threshold **Controls.-** A section of the panel shall contain the **RVR** threshold indicators and setting controls. The indicators are discussed below. The controls shall be miniature toggle switches, double pole in action, momentary in each direction, with a center off, center return position. They shall operate such that a left switch handle movement shall reduce the threshold value, and a right movement shall increase it. Nine such switches shall be mounted as shown in Figure 1.

2-3.3.1.2.8 Alarm.- A suitable area shall be provided to allow the tones from an alarm, described below, to emerge from the front of the display panel.

2-3.3.1.2.9 Marking.- Controls shall be marked for the following functions adjacent to or on the switch:

    Power

    Brightness

Acknowledge

Test

2-3.3.1.2.10 Display Information **Location.**- In conjunction with Figure 2-1, the location and type of display characters shall be as specified.

2-3.3.1.2.10.1 Line **One.**- Characters shall be seven-segment type, spaced as shown. They shall be nominally **0.5** inches **(1.27cm)** high. Seventeen characters shall be used.

2-3.3.1.2.10.2 Lines Two, Three, and Four.- The following character positions shall be seven-segment **0.25** inches **(6.35mm)** high characters: **1, 2, 4, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22,** and **25.** The following character positions shall be **14/16-segment** 0.3125-inch **(7.94mm)** high characters: **3, 5, 6, 7, 8, 13, 18, 23,** and **24.**

2-3.3.1.2.10.3 Line **Five.**- Characters shall be **14/16-segment** 0.3125-inch **(7.94mm)** high characters. Twenty-seven characters shall be on this line.

2.3.3.1.2.10.4 Lines Six, Seven.- The following character positions shall be **14/16-segment** 0.3125-inch **(7.94mm)** high characters: **1, 2, 8, 9, 15,** and **16.** The following character positions shall be seven-segment **0.5-inch (1.27cm)** high characters: **3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 17, 18, 19, 20,** and **21.**

2-3.3.1.2.10.5 Lines Eight, **Nine.**- Characters shall be **14/16-segment** 0.3125-inch **(7.94mm)** high characters. Twenty-seven characters shall be on these lines.

2-3.3.1.2.10.6 RVR Threshold Indicators.- Characters shall be seven-segment, **0.1875-inch (4.76mm)** high characters in pairs above each switch. For minimum horizontal space, no space between pairs is required.

2-3.3.1.2.11 Character Brightness/Indicators.- All **0.5-inch** high seven-segment indicators shall be capable of providing **14,000 foot-lamberts** Line brightness at normal operating voltages, and shall be **IEE** indicator model **FFD41.**

All other indicator units shall be capable of providing at least **9000** foot-lamberts line brightness at normal operating voltages, and shall have lifetime and viewing angles equal to or greater than the above **0.5-inch** units. Background absorption behind the incandescent elements shall be equivalent to the **IEE** unit above.

Acknowledge

Test

2-3.3.1.2.10 Display Information **Location.-** In conjunction with Figure 2-1, the location and type of display characters shall be as specified.

2-3.3.1.2.10.1 Line **One.-** Characters shall be seven-segment type, spaced as shown. They shall be nominally **0.5** inches **(1.27cm)** high. Seventeen characters shall be used.

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two changes per second. The repertoire shall be by two's from 00 to 30 (00, 02, 04, 06, etc.), and by five's from 30 to 60 (30, 35, 40, 45, etc.). The characters shall not be illuminated when the RVR information on the corresponding lines of the Critical Display (lines 2, 3, or 4) are not showing RVR information, or are above an indication of 6000. When values for the corresponding runway and place on the runway, the alarm shall sound, as described below. This function shall be totally internal to the Critical Display, and shall not affect any other Critical Display, each of which shall be able to have different threshold settings for the same runways.

2-3.3.1.2.15 Cooling/Ventilation.- The Critical Display shall be forced air-cooled by a fan capable of pressurizing the Display to reduce the collection of dust and smoke particles. The heat from the indicator units shall be removed through the sides or rear of the display in a manner so as to prevent the heat from damaging any of the screen or other heat sensitive parts, and from affecting the reliability of any of the unit parts. No heat shall be vented through the front, viewing panel face of the display assembly.

2-3.3.1.2.16 Interface/Addressing.- Each Critical Display shall be separately addressable in accordance with the requirements of the CPS and other requirements herein. The displays shall contain interfacing electronics to permit high speed data transfer between the CPS and the display. The update of the display from the CPS shall be in correspondence with the clock time update. The Critical Display shall retain within it, the last message sent. The input message shall contain the alarm, blink, and/or blank code signals appropriate for the current message.

The entire display shall be capable of accepting display data from the CPS at least once every second. The CD shall be capable of receiving a short time message every second without disturbing other displayed data, and receiving a full display update message every second. The CD shall generate an AC power up message when "on" condition preceeded by an "off" condition occurs and CPS shall generate a complete display memory update after this occurs.

2-3.3.1.2.17 Cabling.- All cabling between the Critical Display and the CPS shall be provided, and cabling connections shall be made through locking connectors. Cabling by taps from a single data bus cable shall not be used for the display information in the tower cab. Twenty-five percent spare wires shall be included in all data cables. Signal processors and drivers shall be included with cables if necessary to achieve specified performance.

2-3.3.1.2.18 Power Supply.- The power supply for the Critical Display shall be a separate unit attached by locking connector to the Critical Display. AC power shall route from the main to the Critical Display power switch and then to the power supply unit. The unit shall be a maximum of 0.5 cubic feet in volume with a maximum dimension of 12 inches. It shall be over-voltage and over-current protected as well as input fused. It shall be attached by a cable of approximately 6 feet to the display unit and shall provide regulated voltages and currents as required.
It shall be designed for unattended operation out of sight within a tower cab console for periods of time exceeding 8 months. Power supplies shall be interchangeable between Critical Displays without any internal adjustments. A built-in battery, charged during the time when the AC input power supply is operating, shall supply sufficient power to maintain the stored data in the display memory for 15 minutes minimum.

2-3.3.1.2.19 Test **Functions.-** An operator pressed self-test button shall provide for an internal test activity of the critical paths of data within the Critical Display. Pressing and holding in the button shall locally generate a simulated input computer data message of characters with all segments illuminated and all characters blinking that are specified to blink. The audible alarm shall operate as if an alarm message was sent. This test shall test the processing, memory, character generation, encoding, and displays within the unit, and shall continue in "test" until the button is released. Upon release, the CD shall be locally provided with signals which only test the encoders, drivers, and indicators.

2-3.3.1.2.20 Alarms.- When an alarm code is included with a character, it shall cause the character to blink at a 50 percent duty cycle, 1 second rate, until acknowledged (except for an LLWSAS alarm, where the acknowledge action shall not stop the blinking), and shall actuate a "Sonalert" SC6 or equivalent tone generator to emit 2 half-second tones separated by a half-second space (0.5 seconds on, 0.5 seconds off, 0.5 seconds on). This action will take place when a VAS number changes, a status alert appears,

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It shall be designed for unattended operation out of sight within a tower cab console for periods of time exceeding 8 months. Power supplies shall be interchangeable between Critical Displays without any internal adjustments. A built-in battery, charged during the time when the AC input power supply is operating, shall supply sufficient power to maintain the stored data in the display memory for 15 minutes minimum.

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2-3.3.2.1.2 Log On/Log Off.- The capability shall be provided to log on/log off at an operational position. This function shall be performed by depressing an operator-unique page number sequence.

2-3.3.2.1.3 Manual Request Logging.- The capability shall be provided in the "Supplementary Display" and the CPS to log all manual requests executed on the display at the CPS for future event reconstruction.

2-3.3.2.2 Hardware/Performance Requirements.- These subparagraphs contain hardware/performance requirements for the SD in the display subsystem.

2-3.3.2.2.1 Function and Contents.- The Supplementary Display (SD) shall be a display and control unit containing a cathode ray tube and associated display electronics, character generators, and format generators, memory to store twelve operator selectable display pages, a row of page selector buttons, a set of operator controls, an alarm, interface, and other required and necessary electronic circuitry to perform the function of a remoted, pageable CRT display with special required hardware and software functions, capable of generating and displaying alphanumeric and symbolic character information on a TV rectilinear raster through local refresh. It shall not require a further connection to a central processor after its 12 pages of memory are updated in order to display and select pages of data from its memory. It may contain power supplies and other circuitry in a separate chassis adjacent to the display.

2-3.3.2.2.2 Display Type.- The SD shall contain a 9-inch (diagonal) rectangular cathode ray tube utilizing a P43 phosphor, aluminized. The CRT shall have a safety panel bonded to it with a narrow band filter incorporated between or in the safety panel and the faceplate. The filter characteristics shall be as described below. The safety panel shall contain on its surface an etch as described below, and an anti-reflective coating on the etch as described below. Certification of compliance and certification data for the filter performance, etch performance and the anti-reflective coating performance shall be provided by the contractor/manufacturer.

2-3.3.2.2.1 Filter Requirements.- The color selective filter shall be an integral part of the bonded safety panel. The transmission of the panel shall be a color selective filter with a transmission spectral peak of 530 nanometers, +10 nanometers. The transmission amplitude at the spectral peak shall be 56 percent plus or minus 8 percent of the unattenuated value, and the half-amplitude bandwidth shall be 75 nanometers maximum. This is equivalent to Rohm and Haas acrylic #2092 of appropriate thickness.

2-3.3.2.2.2 Etch Requirements.- The other surface of the safety panel shall be etched. The threshold resolution observed through the etched, uncoated panel shall fall within the range from 1:6, corresponding to 3.5635 line pairs/mm, to 0:2, corresponding to 1.1225 line pairs/mm, when using the USAF resolving power test target, type 1951 (see Figure 2-2) and USAF resolution chart data, Figure 2-3. The method of measurement shall be as follows:

(a) A U.S. Air Force resolving power test target type 1951, Figure 2-2, is placed on a light box and observed through the etched implosion panel. A plexiglass spacer 1-1/2 inches high and 3-3/4 inches in diameter, is used to space the safety panel 1-1/2 inches from the resolution test target.

(b) The brightness of the light box and viewing condition are selected to maximize the unaided resolution of an observer with normal, or corrected-to-normal vision. The observer's vision and viewing conditions may be checked by placing a nonetched panel in the optical path. The observer shall distinguish bars in at least group 3.6 corresponding to 14.25 line pairs/mm.

(c) The acceptance criteria is as follows: Using the test method as described above, the panel etch is acceptable when the threshold resolution observed through the panel is in the range from 1:6 (corresponding to 3.5636 line pairs/mm) to 0:2 (corresponding to 1.1225 line pairs/mm).

2-3.3.2.2.2.3 Antireflective Coating.- an antireflective coating Optical Coating Laboratory, Inc., "HEA" or equal, shall be applied to the etched front surface only of the implosion panel. This coating shall be a high efficiency antireflective coating, which will provide a reflectivity as specified over the wavelength range of 425 nanometers to 700 nanometers, as measured with Gamma Scientific, Co., Model #191 spectrophotometer (or equal), using a smooth, flat, polished glass specimen (witness specimen).

2-3.3.2.2.2.3.1 Surface Reflectance.- The reflectance from the outer surface of the safety panel, measured at an angle between 0 degrees and 15 degrees and at an angle of 30 degrees, shall not exceed the following limits:

2-3.3.2.2.2 Etch Requirements.- The other surface of the safety panel shall be etched. The threshold resolution observed through the etched, uncoated panel shall fall within the range from 1:6, corresponding to 3.5635 line pairs/mm, to 0:2, corresponding to 1.1225 line pairs/mm, when using the USAF resolving power test target, type 1951 (see Figure 2-2) and USAF resolution chart data, Figure 2-3. The method of measurement shall be as follows:

(a) A U.S. Air Force resolving power test target type 1951, Figure 2-2, is placed on a light box and observed through the etched implosion panel. A plexiglass spacer 1-1/2 inches high and 3-3/4 inches in diameter, is used to space the safety panel 1-1/2 inches from the resolution test target.

(b) The brightness of the light box and viewing condition are selected to maximize the unaided resolution of an observer with normal, or corrected-to-normal vision. The observer's vision and viewing conditions may be checked by placing a nonetched panel in the optical path. The observer shall distinguish bars in at least group 3.6 corresponding to 14.25 line pairs/mm.

(c) The acceptance criteria is as follows: Using the test method as described above, the panel etch is acceptable when the threshold resolution observed through the panel is in the range from 1:6 (corresponding to 3.5636 line pairs/mm) to 0:2 (corresponding to 1.1225 line pairs/mm).

2-3.3.2.2.2.3 Antireflective Coating.- an antireflective coating Optical Coating Laboratory, Inc., "HEA" or equal, shall be applied to the etched front surface only of the implosion panel. This coating shall be a high efficiency antireflective coating, which will provide a reflectivity as specified over the wavelength range of 425 nanometers to 700 nanometers, as measured with Gamma Scientific, Co., Model #191 spectrophotometer (or equal), using a smooth, flat, polished glass specimen (witness specimen).

2-3.3.2.2.2.3.1 Surface Reflectance.- The reflectance from the outer surface of the safety panel, measured at an angle between 0 degrees and 15 degrees and at an angle of 30 degrees, shall not exceed the following limits:

MIL-C-675A, paragraphs 4.6.8, 4.6.9, and 4.6.11

MIL-M-13508B, paragraph 4.4.6

MIL-O-13830A, Applicable requirements

MIL-STD-1241A, Optical Forms and Definitions

2-3.3.2.2.3 Raster.- The display shall contain a raster of horizontal lines suitable to display 16 rows of characters of high resolution dot content, at least 9 by 13 dot matrix. The raster shall be of 4:3 aspect ratio, width to height. Thirty-two characters shall be able to be displayed on each line with a 2 dot character space. Characters shall be nominally 6.4mm (0.25 inch) high with a character aspect ratio of 3:4, width to height, nominally.

2-3.3.2.2.4 Size.- The SD shall contain on its front panel, the CRT in a bezel, a set of display controls, a set of page select buttons, an acknowledge button and an alarm. The total frontal dimensions of the SD shall not exceed 205mm (8 inches) by 254mm (10 inches), including controls and switches. The depth of the unit shall not exceed 254mm as a single package, or 205mm if any portion is separated into another unit not to exceed 0.5 cubic feet. The placement of controls, as shown in Figure 2-4, shall be as requirements.

2-3.3.2.2.5 Panel Configuration/Controls.- The controls, as shown in Figure 2-4, shall include the following:

Power Switch - to turn on or off all AC power to the SD

Brightness - to adjust the background raster intensity level

Contrast - to adjust the video intensity level

Ambient brightness sensor - to automatically vary the brightness and/or contrast over a moderate range to reduce or increase the intensity as the ambient varies between 0.1 and 2000 foot-candles.

Acknowledge button - an illuminated momentary push button to generate within the SD, a signal to the CPS to indicate that blinking data on the current page displayed is seen and acknowledged. Following the pressing of the button, all current blinking on the displayed page stops. It shall not acknowledge alarm information on other pages. The termination of blinking

characters is permanent as long as the data that generated the alarm remains the same, even though other pages may be reselected.

Twelve page-select, illuminated, fast-acting, momentary, push button switches with inscribed legends 1 through 12. These buttons shall select and call up from local memory the page chosen. They will also generate a coded signal to the CPS indicating which page was selected.

Function button - an unassigned function momentary push button switch shall provide a digital signal to the CPS indicating that the switch was pressed. No further action shall be taken or caused by the switch action. This function button, shall be included for future capability.

2-3.3.2.2.6 Bezel.- A bezel shall be incorporated such that the SD can be removed from the front of the console. The bezel shall be dull, flat black or dark grey in color, and shall contain a lip at the top of the front of the SD to act as a sunshield. This shield shall protrude a maximum of 2 inches at the top end of the SD.

2-3.3.2.2.7 Ambient Operation.- Character legibility shall be required over the range of less than 0.1 foot-candle to 6000 foot-candles of ambient incident sunlight, or equivalent. Contrast ratio shall be required as follows:

Under conditions of 1 foot-candle ambient, the contrast ratio shall be capable of being increased to 17:1 or greater.

Character brightness uniformity shall not vary more than ±20 percent over the display at the above conditions of 0.1 foot-candle. Line width and spot size under contrast and brightness conditions with 1000 foot-candles shall not exceed 0.4mm (0.015 inch) at the screen center, and shall not exhibit a growth of more than 1.5 to 1 at the edges.

2-3.3.2.2.7.1 Contrast Ratio.- In the measurement of contrast ratio, the contrast ratio (CR) is defined as:

$$CR = \frac{B_{data} + B_{background} \text{ near data}}{B_{background} \text{ near data}}$$

characters is permanent as long as the data that generated the alarm remains the same, even though other pages may be reselected.

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$$CR = \frac{B_{data} + B_{background} \text{ near data}}{B_{background} \text{ near data}}$$

not be used for the display information in the tower cab. Twenty-five
percent spare wires shall be incuded in all data cables. Signal processors
and drivers shall be included with cables if necessary to achieve specified
performance.

2-3.3.2.2.11 Cooling/Ventilation.- The SD shall be designed to operate
continuously for extended periods of time in excess of 120 days with no
heat build-up or maintenance adjustments. No heat shall be vented through
the front, viewing panel face of the assembly..

2-3.3.2.2.12 Power Supplies.- The power supply for the SD may be
incorporated into the SD assembly or may be a separate unit attached by
locking connector to the SD. If separate, AC power shall route from the
mains to the SD power switch and then to the power supply unit. The
separated unit shall be a maximum of 0.5 cubic feet in volume with a
maximum dimension of 12 inches. It shall be DC over-voltage and
over-current protected as well as input fused. It shall be attached by a
cable of approximately 6 feet to the display unit and shall properly
provide regulated voltages and currents as required. It shall be designed
for unattended operation out of sight within a tower cab console for
periods of time exceeding 8 months. External assemblies, power supplies,
etc., shall be interchangeable without any internal adjustments. A
built-in battery, charged during the time when the AC input power supply is
operating, shall supply sufficient power to maintain the stored data in the
display memory for 15 minutes minimum.

2-3.3.2.2.13 Test Functions.- An internally actuated maintenance button
shall control the generation of a test simulated message to the 12th page
in memory to demonstrate the ability of the unit to function properly
without requiring a connection to the CPS. The test message shall include
alarms, and demonstrate and test the blink and acknowledge functions.

2.3.3.2.2.14 Alarm.- The SD shall contain an audible alarm similar to the
alarm in the Critical Display. It shall be maintenance adjustible in
intensity, but shall be of a frequency noticeably different from the alarm
in the Critical Display. Since the SD functions as a flexible format
display, and alarms can be programmed to occur on any type of data change,
it will be used to alert controllers to conditions that may be different
from those that cause alarms in the Critical Display.

2-3.3.2.2.15 Reliability.- Standard commercial practice shall be applied
in the design and manufacturing of the SD to insure that the
mean-time-to-failure of the CRT display portion exceeds 4 months and that
of the remaining portion exceeds 8 months. As a design goal, the entire SD
unit shall have a MTBF in excess of 8 months.

2-3.3.2.2.16 Maintainability.- The SD shall be constructed of standard, commercially available parts. The packaging shall conform to good commercial practice. All cards shall be plug-in where practicable, and a reliable method of wiring shall be utilized. High Voltage shall be provided in a manner that does not interfere with any other electronic instrument or device in the tower cab, and shall not exceed 16,000 volts. No device name or mounting points shall be provided on the power supply or an external assembly for wall mounting. Prior contract officer approval shall be required for the use of any custom packaged electronic parts that are nonrepairable.

2-3.3.3 TRACON Display

2-3.3.3.1 Operational/Performance Requirements.- These subparagraphs contain operational/performance requirements for the TD in the display subsystem.

2-3.3.3.1.1 Continuous **Display.-** The top four lines of data shall initially contain the same parameters in a similar format of data as displayed on a "Critical Display." This critical data shall be displayed continuously, and shall be formatted initially as in Figure 2-6.

2-3.3.3.1.2 Update Time.- Time shall be updated, independent of other data updated from the CPS, once a second.

2-3.3.3.1.3 Data Paging.- The capability shall be provided to manually request any one of twelve (12) locally lower lines of the display. A displayed data page shall continue to be displayed and updated, until a manual request for another data page is executed.

2-3.3.3.1.4 Log On/Log Off.- The capability shall be provided to log on/log off at an operational position. This function shall be performed by depressing an operator-unique page number sequence.

2-3.3.3.1.5 Manual Request **Logging.-** The capability shall be provided by the "TRACON Display" and the CPS to log all manual requests executed on the display at the CPS for future event reconstruction. The RVR threshold shall not be included.

2-3.3.3.2 Hardware/Performance **Requirements.-** These subparagraphs contain hardware/performance requirements for the TD in the display subsystem.

2-3.3.2.2.16 Maintainability.- The SD shall be constructed of standard, commercially available parts. The packaging shall conform to good commercial practice. All cards shall be plug-in where practicable, and a reliable method of wiring shall be utilized. High Voltage shall be provided in a manner that does not interfere with any other electronic instrument or device in the tower cab, and shall not exceed 16,000 volts. No device name or mounting points shall be provided on the power supply or an external assembly for wall mounting. Prior contract officer approval shall be required for the use of any custom packaged electronic parts that are nonrepairable.

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2-3.3.3.1.5 Manual Request Logging.- The capability shall be provided by the "TRACON Display" and the CPS to log all manual requests executed on the display at the CPS for future event reconstruction. The RVR threshold shall not be included.

2-3.3.3.2 Hardware/Performance Requirements.- These subparagraphs contain hardware/performance requirements for the TD in the display subsystem.

The panel shall include a power switch, a brightness control, a set of
12-page select buttons, an "acknowledge" button, and an unassigned function
mometary push button switch. This switch shall provide a digital signal to
the CPS indicating that the switch was pressed. No further action shall be
taken or caused by the switch action. The function switch is intended for
future capability.

2-3.3.3.2.5 Controls.- The TD shall contain an on/off toggle switch which
shall control all AC power to the power supply. An operator adjustable
brightness control shall vary the brightness of the gas discharge panel by
varying the refresh rate between 50 and 125 scans per character per second.
 The same control shall vary the brightness of the RVR threshold characters
in a coordinated manner. A set of 12 illuminated momentary push buttons
designated 1 through 12, shall be provided to permit the user to select one
of twelve pages of stored information for display. The same buttons, or
their rspective actions, shall provide back to the CPS, a signal indicating
the page selected, to be used for logging purposes. A single button
designated an "acknowledge" button, shall be an illuminated momentary push
button which shall cause any blinking information to stop blinking on the
page selected. It shall not acknowledge alarm information on other pages
not displayed. The termination of blinking characters in permanent as long
as the data that generated the alarm remains the same, even though other
pages may be reselected. Blinking shall be at a 50 percent duty cycle, one
second rate.

2-3.3.3.2.6 RVR Threshold Panel.- This paragraph requires the identical
performance of paragraph 2-3.3.1 for the RVR threshold panel. The
indicator devices and circuitry used in the RVR threshold panel shall be
identical to the devices and circuitry used in the Critical Display RVR
threshold panel. In addition, a green filter shall be placed over the
characters to make them appear approximately the same color as the green
plasma display.

2.3.3.3.2.7 Ambient Operation/Overlay.- The TD will be used in an ambient
varying from less than 0.1 foot-candles to as much as 10 foot-candles. It
shall contain a green colored, lightly etched plastic overlay on top of the
gas discharge panel to enhance contrast and reduce reflections. The
overlay shall provide, nominally, a 40 percent attenuation at 520
nanometers wavelength (green). Consideration shall be given in the design
of the illuminated push buttons to the use of glare-free button caps and
light sources to minimize the variations of the intensity of light sources,
including the gas discharge characters, on the TD.

2-3.3.3.2.8 **Interface/Addressing.-** Each TRACON display shall be separately
addressable in accordance with the requirements of the CPS and as specified
in other parts of this ER. The display shall contain interfacing
electronics to permit high speed data transfer between the CPS and the
display unit. The TD shall be capable of accepting display data from the
CPS at least once every second. The TD shall be capable of receiving a
short "time" message every second without disturbing other displayed data,
and receiving a full displayed page update message every second. The TD
shall retain within it, the information for 12 pages of display information
from the last messages sent,, and shall be capable of displaying such
information and page selection when disconnected from the signals
appropriate for th current message. Page update times shall be as
specified in section **2-3.3.2.2.9.**

Interfacing shall be included which shall transfer from the TD to the CPS
the **acknowledge** response to an alarm indication, and the addressed
referenced page selected by the particular TD, for logging purposes.

When an **alarm** is sent on a page that is not selected, an indication of
alarm and page number shall appear at the extreme lower right of the
display, as part of the 512 allowable character positions. This may be a
locally generated function since each TD can be viewing a different page at
the same time. Blinking shall occur at a 50 percent duty cycle, one second
rate,

2-3.3.3.2.9 Cabling.- All cabling between the TD and the central processor
shall be provided, and cabling connections shall be made through locking
connectors. Cabling by taps from a single data bus cable shall not be used
for the display information in the TRACON. Twenty-five **percent spare** wires
shall be included in all data cables. Signal processors and drivers shall
be included with cables if necessary to achieve specified performance.

2-3.3.3.2.10 Power Supply.- The power supply for the TD may be
incorporated into the TD or may be a separate unit attached by locking
connector to the TD. If separate, AC power shall route from the mains to
the TD power switch and then to the power supply unit. The separated unit
shall have a maximum dimension of 12 inches. It shall be DC over-voltage
and over-current protected and shall be input fused. It shall be attached
by a cable of approximately 6 feet to the display unit and shall properly
provide regulated voltages and current as required. It shall be designed
for unattended operation, out of sight, within TRACON consoles

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Interfacing shall be included which shall transfer from the TD to the CPS the **acknowledge** response to an alarm indication, and the addressed referenced page selected by the particular TD, for logging purposes.

When an **alarm** is sent on a page that is not selected, an indication of alarm and page number shall appear at the extreme lower right of the display, as part of the 512 allowable character positions. This may be a locally generated function since each TD can be viewing a different page at the same time. Blinking shall occur at a 50 percent duty cycle, one second rate,

2-3.3.3.2.9   Cabling.- All cabling between the TD and the central processor shall be provided, and cabling connections shall be made through locking connectors. Cabling by taps from a single data bus cable shall not be used for the display information in the TRACON. Twenty-five **percent spare** wires shall be included in all data cables. Signal processors and drivers shall be included with cables if necessary to achieve specified performance.

2-3.3.3.2.10 Power Supply.- The power supply for the TD may be **incorporated** into the TD or may be a separate unit attached by locking **connector** to the TD. If separate, AC power shall route from the mains to the TD power switch and then to the power supply unit. The separated unit shall have a maximum dimension of 12 inches. It shall be DC over-voltage and over-current protected and shall be input fused. It shall be attached by a cable of approximately 6 feet to the display unit and shall properly provide regulated voltages and current as required. It shall be designed for unattended operation, out of sight, within TRACON consoles

2-3.3.4.1.1 Log On/Log Off.- Security shall be provided for entering the system. A log on/log off capability shall be provided. The log on procedure shall include entering a valid user ID and password. Associated with a valid user ID and password shall be an access level number Ø, 1, or 2, as described in Appendix 1-2.

2-3.3.4.1.2 Data Paging.- The capability shall be provided to display any one (24 line x 80 character) or any two (simultaneously) supplemental data pages (16 line x 32 character) for all three access levels. There shall be addressing capability for up to 256 supplemental data pages. For the initial system and by default, the following data pages shall be assigned to each "Supplementary Display" and accessed by an SMD.

2-3.3.4.1.2.1 Backup Critical Display Data Page.- This data page shall serve as a backup for the "Critical Display." The data contained in this page shall include all the data displayed on the "Critical Displays," including runway data for all runways assigned. The boundary surface wind data shall be displayed for all boundaries (see Figure 2-7).

2-3.3.4.1.2.2 RVR Data Page.- This data page shall contain as many as three runway visual range for each runway and for all runways.

2-3.3.4.1.2.3 ILS Status Data Page.- This data page shall contain status data for each ILS (glide slope, localizer, inner markers, middle marker, outer marker, and far field monitor) at the airport and for both the main and standby equipment.

2-3.3.4.1.2.4 ALS/MALS Data Page.- This data page shall contain status data and lighting systems intensity levels for ALS and MALS for all runways.

2-3.3.4.1.2.5 Field Lighting Data Page.- This data page shall contain status data for the field lighting systems.

2-3.3.4.1.3 Enable/Disable Sensor Data.- The capability shall be provided for access levels 1 and 2 to disable parameter data collected by sensors from being displayed, and re-enabling the displaying of the sensor collected data.

2-3.3.4.1.4 Manual Data Entry.- The capability shall be provided for access level 2 (access level 1 on a limited basis) to manually enter the following types of data (see FAA Handbook 7210.3, section 2), in accordance with Appendix 1-2.

2-3.3.4.1.4.1 <u>Critical **Data.**</u>- The capability shall be provided for access level 2 users to manually enter sensor data to override the data collected by a sensor.

2-3.3.4.1.4.2 <u>Adaptation Parameters.</u>- Access level 2 users shall be provided the capability to set values to adaptation parameters.

2-3.3.4.1.4.3 <u>Supplemental **Data.**</u>- The capability shall be provided for access levels 1 and 2 to enter supplemental data into the supplemental data pages, while access level 2 shall also be provided the capability to format the supplemental data pages.

2-3.3.4.1.5 <u>Runway **Assignment.**</u>- The capability shall be provided for access levels 1 and 2 to assign runways to specific "Critical Displays."

2-3.3.4.1.6 <u>Display **Configuration.**</u>- The capability shall be provided for access levels 1 and 2 to execute predetermined display configurations. Also, the capability shall be provided for access level 2 users to create a display configuration and add it to the configurations table.

2-3.3.4.1.7 <u>Text **Messages.**</u>- The capability shall be provided for access levels 1 and 2 to send free form text messages to other supervisor display/terminals and the **CPS** operator's display/terminal.

2-3.3.4.2 <u>Hardware/Performance **Requirements.**</u>- These subparagraphs contain hardware/performance requirements for the **SMD** in the display subsystem.

2-3.3.4.2.1 <u>**Functions/Contents.**</u>- A Supervisory/Maintenance Display **(SMD)** shall be a commercially available data terminal which shall contain a cathode ray tube display with a special front surface treatment, a full standard ASCII alphanumeric keyboard, local refresh, character generation and format control memory adequate to store one page of information, editing features, and blink and reverse video features. It shall contain all electronic circuitry required to display computer generated coded character information, to manually enter, change, and delete information on the CRT screen, and to transmit such information back to the central processor for distribution as page information for the Critical Displays, Supplementary Displays, and **TRACON** Displays. It shall contain an audible alarm which shall function when alarm coded information is received by the **SMD.**

2-3.3.4.1.4.1 Critical **Data.-** The capability shall be provided for access level 2 users to manually enter sensor data to override the data collected by a sensor.

2-3.3.4.1.4.2 Adaptation Parameters.- Access level 2 users shall be provided the capability to set values to adaptation parameters.

2-3.3.4.1.4.3 Supplemental **Data.-** The capability shall be provided for access levels 1 and 2 to enter supplemental data into the supplemental data pages, while access level 2 shall also be provided the capability to format the supplemental data pages.

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2-3.3.4.2.7 Cabling.- All cabling between the SMD and CPS shall be
provided, and cabling connections shall be made through locking connectors.
Each SMD shall be connected to the central processor by a separate cable.
Twenty-five percent spare wires shall be included in all data cables.
Signal processors and drivers shall be included with cables if necessary to
achieve specified operation.

2-3.3.4.2.8 Test Functions.- An internally stored test message shall be
capable of being generated to the local memory as if it were coming from
the CPS through the interface to simulate a page for display. It shall
include alarm and blink codes to test the alarm and any acknowledge
function programmed into the SMD. This test shall function in the SMD
without requiring a connection to the CPS. In addition, local typing and
editing shall be performable in the memory or into data in memory with no
CPS connection.

2-3.3.4.2.9 Alarm.- The SMD shall contain an audible alarm similar to the
alarm in the Critical Display. It shall be maintenance adjustable in
intensity, and shall be of a noticeably different frequency from the alarms
in the CD, SD, or TD. Since the SMD functions as a flexible format
display, and alarms can be programmed to occur on any type of data change,
it will be used to alert controllers, supervisors, or maintenance personnel
to conditions that may be different from those that cause alarms in the
other displays. The capability shall be provided for manual selection of a
continuous audible alarm, only stopped by an acknowledge action, and a
short alarm as described in section 2-3.3.1.2.20.

2-3.3.4.2.10 Reliability.- An SMD shall be selected, designed, and
adjusted to operate at very conservative levels to insure extremely long
life and to maximize the MTBF. As a goal, the MTBF shall be 5000 hours.
Best commercial practice shall be applied with the requirement for
continuous "on" operation, unattended for many hours per day. The keyboard
utilized shall be capable of accepting the rigors of frequent inputs by
non-typists. A tactile feedback keyboard shall be utilized.

2-3..4.2.11 Maintainability.- An SMD shall be of a type employing
standard, commercially available parts. The packaging shall conform to
best commercial practice. Circuits shall be on plug-in cards where
practicable. High voltage shall not exceed 16,000 volts under any
conditions. No device name or nomenclature shall appear on the front panel
of the unit. Prior contract officer approval shall be required for the use
of any custom packaged electronic parts that are nonrepairable.

2-3.3.5 Lighting Control Panel

2-3.3.5.1 Operational/Performance Requirements.- These subparagraphs contain operational/performance requirements for the **LCP** in the display subsystem.   The lighting control panel shall perform the functions defined in the following subparagraphs.

2-3.3.5.1.1 Select Intensity **Level.-** The lighting control panel shall provided the capability to manually select a specific airport lighting system's intensity level, ranging from zero **(0** = off) to five **(5 =** maximum) depending upon the capability of each lighting system. Upon selection, the **CPS** shall transmit the request to the appropriate lighting system's remote maintenance monitoring subsystem **(RMMS)** to be executed or as specified in the contract.

2-3.3.5.1.2 Acknowledge Lighting Intensity.- The capability shall be provided to light an indicator, upon command from the **CPS,** to acknowledge that the selected airport lighting system intensity level has been achieved.

2-3.3.5.1.3 Manual Request **Logging.-** The capability shall be provided in the **CPS** to log all manual requests executed on the lighting control panel at the **CPS** for future event reconstruction.

2-3.3.5.2 Hardware/Performance **Requirements.-** These subparagraphs contain hardware/performance requirements for the **LCP** in the display subsystem.

2-3.3.5.2.1 Functions and **Contents.-** The lighting control panel shall be a control unit for monitoring the levels and status of certain airport lighting systems, and for effecting changes in the operating brightness levels of these systems. It combines some of the present controls and indicator panel, and a computer responsive key entry panel. It contains a set of level buttons, and three sets of lighting function buttons/indicators, one for each of three runways. It also contains interface, logic, and power supplies necessary to function properly to accept legend select signals, drive the lamps, accept switch signals, and interface them with the **CPS.** It shall also contain an illuminated, momentary push button test switch.

2-3.3.5.2.2 Hardware **Description.-** The switches/indicators shall be of four types, depending on their use on the panel, as shown on Figure **2-8.**

2-3.3.5.2.2.1 Type A.- Type A shall be a combination switch and indicator which shall be a rear-projected multi-legend illuminated switch and indicator, type IEE-Proswitch Series 2205, #60013, with #7335 lamps, or equal.   The 12-legend film shall contain a set of legends unique for each lighting type, as described below.   The switch shall be SPDT momentary switch which shall control a logic output to the CPS.

2-3.3.5.2.2. Type B.- Type B shall be a rear-projected multilegend illuminated indicator, type IEE Series 22000 indicator, #60012, with #7335 lamps, or identical.   The 12-legend film shall contain the designations of the runways at the airport, to be specified in the contract.

2-3.3.5.2.2.3 Type C.- Type C shall be an illuminated push-on/push-off switch of approximately the same size as switch Type A.   The legend or key cap shall be brightly illuminated when the switch corresponds to "on," and very dimly illuminated when the switch corresponds to "off."   The legend subject shall be "Sequence Flashers."   The switch shall be flush mounted.

2-3.3.5.2.2.4 Type D.- Type D shall be an illuminated momentary push button approximately 12mm by 12mm, flush mounted.   Six such switches shall be mounted as shown in Figure 2-8 and permanent shall be OFF, 1, 2, 3, 4, and 5.

2-3.3.5.2.3 Power.- An on/off power toggle switch shall be included on the panel as shown in Figure 2-8.

2-3.3.5.2.4 Test.- An illuminated, momentary, push button switch shall be included on the panel as shown in Figure 2-8.

2-3.3.5.2.5 Panel Layout.- The panel shall be laid out as close as possible to that shown in Figure 2-8.   The panel dimensions shall not exceed 155mm by 155mm including a bezel for mounting purposes.   The depth of the unit behind the panel shall be limited to 230mm, including circuitry and power supply if necessary.

2-3.3.5.2.6 Ambient Operation.- The lighting control panel shall be designed for use in a tower cab environment, ranging from less than 0.1 foot-candles to greater than 2000 foot-candles. The lighting panel shall be operative and indicators illuminated when the power toggle switch is in the "on" position.   In the "off" position, all indicators shall be unilluminated, and none of the push buttons shall control any actions.

2-3.3.5.2.2.1 Type A.- Type A shall be a combination switch and indicator which shall be a rear-projected multi-legend illuminated switch and indicator, type IEE-Proswitch Series 2205, #60013, with #7335 lamps, or equal. The 12-legend film shall contain a set of legends unique for each lighting type, as described below. The switch shall be SPDT momentary switch which shall control a logic output to the CPS.

2-3.3.5.2.2. Type B.- Type B shall be a rear-projected multilegend illuminated indicator, type IEE Series 22000 indicator, #60012, with #7335 lamps, or identical. The 12-legend film shall contain the designations of the runways at the airport, to be specified in the contract.

2-3.3.5.2.2.3 Type C.- Type C shall be an illuminated push-on/push-off switch of approximately the same size as switch Type A. The legend or key cap shall be brightly illuminated when the switch corresponds to "on," and very dimly illuminated when the switch corresponds to "off." The legend subject shall be "Sequence Flashers." The switch shall be flush mounted.

2-3.3.5.2.2.4 Type D.- Type D shall be an illuminated momentary push button approximately 12mm by 12mm, flush mounted. Six such switches shall be mounted as shown in Figure 2-8 and permanent shall be OFF, 1, 2, 3, 4, and 5.

2-3.3.5.2.3 Power.- An on/off power toggle switch shall be included on the panel as shown in Figure 2-8.

2-3.3.5.2.4 Test.- An illuminated, momentary, push button switch shall be included on the panel as shown in Figure 2-8.

2-3.3.5.2.5 Panel Layout.- The panel shall be laid out as close as possible to that shown in Figure 2-8. The panel dimensions shall not exceed 155mm by 155mm including a bezel for mounting purposes. The depth of the unit behind the panel shall be limited to 230mm, including circuitry and power supply if necessary.

2-3.3.5.2.6 Ambient Operation.- The lighting control panel shall be designed for use in a tower cab environment, ranging from less than 0.1 foot-candles to greater than 2000 foot-candles. The lighting panel shall be operative and indicators illuminated when the power toggle switch is in the "on" position. In the "off" position, all indicators shall be unilluminated, and none of the push buttons shall control any actions.

detailed under Part 1 of the **ER** applies to all parts of the **CCD/RMMS** while the following paragraphs specifically relate to the display subsystem. The contractor may utilize existing material or material that may contain the required information within an existing document. Submission and approval of documentation material shall be in the quantities and in accordance with the schedule specified in the contract. Updating of the required documentation shall be accomplished periodically to maintain the documentation in current status.

2-3.5.1 Hardware **Documentation.-** Hardware documentation shall be provided in accordance with the requirements of Part 1 of the **ER.**

2-3.5.2 Software **Documentation.-** A display subsystem functional specification and design specification shall be supplied in accordance with Part 1 of the **ER.** The documentation for the display subsystem software shall be contained in the **CPS** operational program documentation detailed under Part 3 of the **ER.** There shall be an operator's manual provided for each type of display/terminal, and lighting control panel in the display subsystem. Each operator manual shall contain the following information:

(a) Startup procedure

(b) Log on/log off commands

(c) List of commands (requests), their descriptions, and procedures to invoke them.

(d) Describe outputs available, provide output samples, and describe how to obtain them.

(e) List of error message (conditions) and the procedure to follow for each error condition.

2-3.6 Design and Construction

2-3.6.1 General **Requirements.-** The display subsystem equipment (displays, display/terminals, and lighting control panels) shall be designed to provide high operational availability and good accessibility for maintenance and repair or replacement of components. Off-the-shelf components, assemblies, and equipment shall be used to the greatest extent possible. Construction and fabrication shall be in accordance with the best commericial practices.

Because of space limitations in the tower cab and TRACON, the physical size of the displays and lighting control panels shall be kept as small as possible, consistent with the accessiblity and maintainability requirements.

2-3.6.2 Ventilation and Cooling.- All blowers, vents, and cooling of the equipment shall be provided as necessary. Equipment requiring forced ventilation shall not require ducts to be installed. Input air filters for all equipment shall be provided in accordance with best commercial practice as necessary.

2-3.6.3 Fuses.- Fuses shall be readily replaceable and located in a convenient servicable location.

2-3.6.4 Subsystem Grounding.- The grounding design of the display subsystem must be compatible with other equipment with which it will interface. There shall be no degradation of signals between equipments due to cross-coupling through the ground system. The contractor shall be responsible for interfacing his system grounding with existing systems.

2-3.6.5 Conducted and Radiated Interference.- The equipment specified herein shall satisfy the basic limits of interference and susceptability as specified in MIL-STD-461. Should the proposed equipment have been built to comply with any interference control specification other than MIL-STD-461, the FAA will accept the specification in lieu of MIL-STD-461 provided that the requirements of the two specifications are generally comparable.

2-3.6.6 Cables.- The contractor shall furnish all cables, cable connectors, terminal boards, etc., required for factory and site testing and installation of the equipment. This shall include any special purpose test cables or card extenders required for routine maintenance. All cables shall be supplied with connectors installed unless otherwise specified in the contract. Any special tools and instructions required for cable fabrication shall be furnished by the contractor as special test equipment.

2-3.6.7 Service Conditions.- The equipment herein shall perform in accordance with the requirements of this ER under the service conditions listed below. The equipment will be contained within an attended facility and the normal ambient temperature of the environment in which the equipment will be installed will be 72 degrees Fahrenheit (22 degrees Celsius). Service conditions including A/C line parameters, are as follows:

Because of space limitations in the tower cab and TRACON, the physical size of the displays and lighting control panels shall be kept as small as possible, consistent with the accessiblity and maintainability requirements.

2-3.6.2 Ventilation and Cooling.- All blowers, vents, and cooling of the equipment shall be provided as necessary. Equipment requiring forced ventilation shall not require ducts to be installed. Input air filters for all equipment shall be provided in accordance with best commercial practice as necessary.

2-3.6.3 Fuses.- Fuses shall be readily replaceable and located in a convenient servicable location.

2-3.6.4 Subsystem Grounding.- The grounding design of the display subsystem must be compatible with other equipment with which it will interface. There shall be no degradation of signals between equipments due to cross-coupling through the ground system. The contractor shall be responsible for interfacing his system grounding with existing systems.

2-3.6.5 Conducted and Radiated Interference.- The equipment specified herein shall satisfy the basic limits of interference and susceptability as specified in MIL-STD-461. Should the proposed equipment have been built to comply with any interference control specification other than MIL-STD-461, the FAA will accept the specification in lieu of MIL-STD-461 provided that the requirements of the two specifications are generally comparable.

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2-3.6.7 Service Conditions.- The equipment herein shall perform in accordance with the requirements of this ER under the service conditions listed below. The equipment will be contained within an attended facility and the normal ambient temperature of the environment in which the equipment will be installed will be 72 degrees Fahrenheit (22 degrees Celsius). Service conditions including A/C line parameters, are as follows:

(b) Supplementary Display - The specified **MTBF** shall be   4000
hours with an **MTTR** of 1 hour or less.

(c) Lighting Control Panel - The specified **MTBF** shall be
4000 hours with an **MTTR** of 1 hour or less.

(d) **TRACON** Display - The specified **MTBF** shall be 4000   hours
with an **MTTR** of 1 hour or less.

(e) Supervisory/Maintenance Display - The specified **MTBF**
shall be 4000 hours with an **MTTR** of 1 hour or less.

Manufacturer's literature shall be provided as part of the reliability
assertations when such literature contains statements concerning the **MTBF**
failure rates or life of any of the included units.

2-3.6.10.1 Maintenance **Approach.**- Ease and speed of repairs are required
so that maximum readiness of the equipment is obtained. Immediate
indication of the need for maintenance is essential in order to effect
repairs in a timely manner. The maintenance approach shall be to localize
failures through the use of software and hardware maintenance features, and
to replace the failed module, element, or pluggable unit from spares. The
actual repair of the replaced item will be accomplished off-line in a bench
repair area. The equipment shall be designed to minimize the requirements
for preventive maintenance. Each display, display/terminal, and lighting
control panel shall not require **more** than 1 hour per month for this
purpose.

2-4 Quality Assurance Provisions

2-4.1 General.- General provisions for providing and maintaining a quality
control program are detailed in Part 1 of the **ER.**

2-5 Preparation for Delivery

See Part 1 of the **ER.**

, APPNDIX 2-1 TABLE OF CONTENTS

, APPNDIX 2-1 TABLE OF CONTENTS

USAF RESOLUTION CHART DATA
NOMENCLATURE AND SPECIFICATIONS

The proportionality of the line and element dimensions is given by the ratio of the unit widths of two subsequent elements. This ratio shall be the sixth root of two. At the head of every group shall be a group number indicating the number of li/mm of the largest pattern within the group in terms of powers of two. For example, a group number K-3 shall indicate eight li/mm for the largest pattern of this group. The group numbers shall be whole numbers, for example—1, 0, 1 etc. Within a group, every element shall be designated by an element number n = 1 (number 1 belonging to the largest element) through number 6 (number 6 belonging to the smallest element). The resolving power R represented by the element n of group K of the target can then be calculated from the equation.

$$R = {}_2K \text{ plus } n\text{-}1$$
$$\overline{.6}$$

Thus element 1 of group —2 has 0.25 li/mm, element 1 of group —1 has 0.5 li/mm, and element 1 of group 0 has 1 li/mm.

The range of the target shall include ten target groups from 0.25 to 227.5 li/mm or from group —2 to group 7.

terval—a line or a space.
iit—a line and the adjacent space.
ttern—three lines and two included spaces.
ement—an arrangement of two patterns set at right angles to each other and separated by one unit width.

GROUP —2		GROUP —1	
(1) .25 li m/m	Interval = .07874 Unit = .15748 Element .94488 X .3937	(1) .50 li. m/m	Interval = .03937 Unit = .07874 Element .47244 x .19685
(2) .280625 li. m/m	Interval = .07014699 Unit = .14029398 Element .84176388 X .35073495	(2) .56125 li. m/m	Interval = .03507349665 Unit = .0701469933 Element .4208819598 x .17536748325
(3) .317475 li. m/m	Interval = .06200488225 Unit = .1240097645 Element .744058587 x .31002441125	(3) .63495 li. m/m	Interval = .0310024411 unit = .0620048822 Element .3720292932 x .1550122055
(4) .356175 li.m / m	Interval = .0552677756 Unit = .1105355513 Element .6632133078 X .27633887825	(4) .71235 li. m/m	Interval = .0276338878 unit = .0552677756 Element .33160 6536 x .138169439
(5) .3994 li.' m / m	Interval = .0492864296 Unit = .0985728592 Element .5914371552 X .246432148	(5) .7988 li. m/m	Interval = .0246432148 Unit = .0492864296 Element .29571£ 776 X .123216074
(6) .44545 li. m/m	Interval = .04419126725 Unit = .0883825345 Element .5302952 1?: X .2209563385	(6) .8909 li. m/m	Interval = .0220956336 Unit = .0441917672 Element .2651476032 x .110478168

Figure 2-3   **USAF Resolution Chart Data Table**

GROUP + 0

(1)
1 li. m/m —————— {
Interval = .019685
Unit = .03937
Element .23622 × .098425
}

(2)
1.1225 li. m/m ——— {
Interval = .01753674832
Unit = .03507349665
Element .2104409799 × .087683741625
}

(3)
1.2599 li. m/m ——— {
Interval = .01550122056
Unit = .03100244113
Element .18601464678 × .077506102825
}

(4)
1.4142 li. m/m ——— {
Interval = .01381694391
Unit = .02763388783
Element .16580332698 × .069084719575
}

(5)
1.5874 li. m/m ——— {
Interval = .01232160741
Unit = .02464321482
Element .14785928892 × .06160803705
}

(6)
1.7818 li. m/m ——— {
Interval = .01104781681
Unit = .02209563362
Element .13257380172 × .05523908405
}

GROUP + 1

(1)
2 li. m/m —————— {
Interval = .0098425
Unit = .019685
Element .11811 × .0492125
}

(2)
2.245 li. m/m ——— {
Interval = .00876837416
Unit = .01753674832
Element .10522048992 × .0438418708
}

(3)
2.5398 li. m/m —— {
Interval = .00775061028
Unit = .01550122056
Element .0900732336 × .0387530514
}

(4)
2.8494 li. m/m —— {
Interval = .00690847195
Unit = .01381694391
Element .08290165346 × .034542359775
}

(5)
3.1952 li. m/m —— {
Interval = .0061608037
Unit = .01232160741
Element .07392964446 × .030804018525
}

(6)
3.5636 li. m/m —— {
Interval = .0055239084
Unit = .01104781681
Element .06628690085 × .027619542025
}

GROUP + 2

(1)
4 li. m/m —————— {
Interval = .00492125
Unit = .0098425
Element .059055 × .02460625
}

(2)
4.49 li. m/m ——— {
Interval = .00438418708
Unit = .00876837416
Element .05261024496 × .0219209354
}

(3)
5.0796 li. m/m - - {
Interval = .00387530514
Unit = .00775061028
Element .04650366168 × .0193765257
}

(4)
5.6988 li. m/m —— {
Interval = .003454235975
Unit = .00690847195
Element .0414508257 × .017271177375
}

(5)
6.3904 li. m/m ——— {
Interval = .0030804018
Unit = .0061608037
Element .0369648222 × .01540200925
}

(6)
7.1272 li. m/m —— {
Interval .002761950055239084
Element .0331434504 × .013809771
}

GROUP + 3

(1)
8 li. m/m —————— {
Interval = .002460625
Unit = .00492125
Element .0295275 × .012303125
}

(2)
8.98 li. m/m — ——— {
Interval = .00219209354
Unit = .00438418708
Element .02630512248 × .0109604677
}

(3)
10.1592 li. m/m ……… {
Interval = .00193765257
Unit = .00387530514
Element .02325 1830852 × .0096882626655
}

(4)
11.3976 li. m/m .——— {
Interval = .00172711799
Unit = .00345423597
Element .020725415874 × .00863558994
}

(5)
12.7808 li. m/m ——— {
Interval = .0015402009
Unit = .0030804018
Element .018482411112 × .00770100463
}

(6)
14.2544 li. m/m ——— {
Interval = .0013809771
Unit = .0.2761954200
Element .016671726218 × .00490400850
}

Figure 2- 3 (continued)

GROUP+0

(1) 1 li. m/m ——— Interval = .019685, Unit = .03937, Element .23622 × .098425

(2) 1.1225 li. m/m ——— Interval = .01753674832, Unit = .03507349665, Element .2104409799 × .087683741625

(3) 1.2599 li. m/m ——— Interval = .01550122056, Unit = .03100244113, Element .18601464678 × .077506102825

(4) 1.4142 li. m/m ——— Interval = .01381694391, Unit = .02763388783, Element .16580332698 × .069084719575

(5) 1.5874 li. m/m ——— Interval = .01232160741, Unit = .02464321482, Element .14785928892 × .06160803705

(6) 1.7818 li. m/m ——— Interval = .01104781681, Unit = .02209563362, Element .13257380172 × .05523908405

GROUP+1

(1) 2 li. m/m ——— Interval = .0098425, Unit = .019685, Element .11811 × .0492125

(2) 2.245 li. m/m ——— Interval = .00876837416, Unit = .01753674832, Element .10522048992 × .0438418708

(3) 2.5398 li. m/m ——— Interval = .00775061028, Unit = .01550122056, Element .0900732336 × .0387530514

(4) 2.8494 li. m/m ——— Interval = .00690847195, Unit = .01381694391, Element .08290165346 × .034542359775

(5) 3.1952 li. m/m ——— Interval = .0061608037, Unit = .01232160741, Element .07392964446 × .030804018525

(6) 3.5636 li. m/m ——— Interval = .0055239054, Unit = .01104781681, Element .06628690085 × .027619542025

GROUP+2

(1) 4 li. m/m ——— Interval = .00492125, Unit = .0098425, Element .059055 × .02460625

(2) 4.49 li. m/m ——— Interval = .00438418708, Unit = .00876837416, Element .05261024496 × .0219209354

(3) 5.0796 li. m/m ——— Interval = .00387530514, Unit = .00775061028, Element .04650366168 × .0193765257

(4) 5.6988 li. m/m ——— Interval = .003454235975, Unit = .00690847195, Element .0414508257 × .017271177375

(5) 6.3904 li. m/m ——— Interval = .0030804018.., Unit = .0061608037, Element .0369648222 × .01540200925

(6) 7.1272 li. m/m ——— Interval .00276195.0055239084, Element .0331434504 × .013809771

GROUP+3

(1) 8 li. m/m ——— Interval = .002460625, Unit = .00492125, Element .0295275 × .012303125

(2) 8.98 li. m/m ——— Interval = .00219209354, Unit = .00438418708, Element .02630512248 × .0109604677

(3) 10.1592 li. m/m ——— Interval = .00193765257, Unit = .00387530514, Element .023251830852 × .009688262655

(4) 11.3976 li. m/m ——— Interval = .001727117985, Unit = .00345423597, Element .020725415874 × .008635589941

(5) 12.7808 li. m/m ——— Interval = .0015402009.., Unit = .0030804018.., Element .018482411112 × .00770100463

(6) 14.2544 li. m/m ——— Interval = .00138097710, Unit = .0276195420, Element .016871725218 × .00490400550

Figure 2- 3 (continued)

Figure 2-4 Supplementary Display Layout

Figure 2-4 Supplementary Display Layout

Line #

```
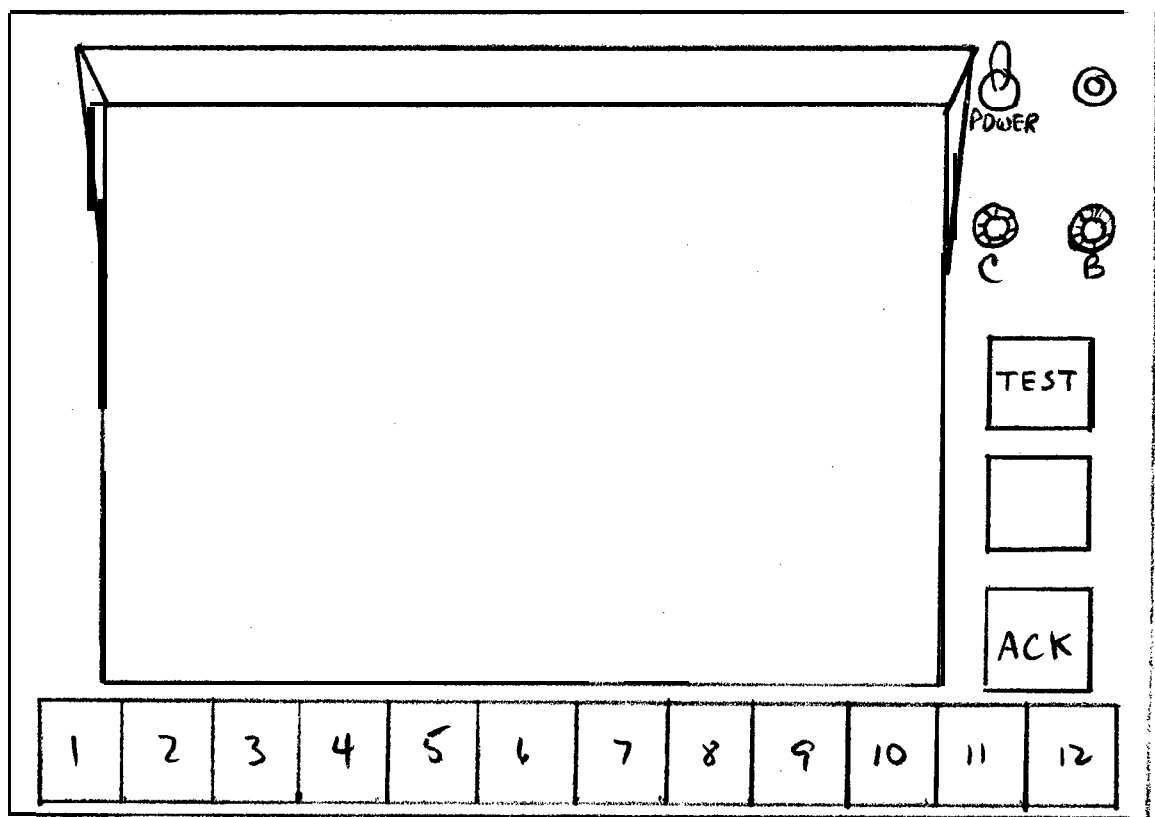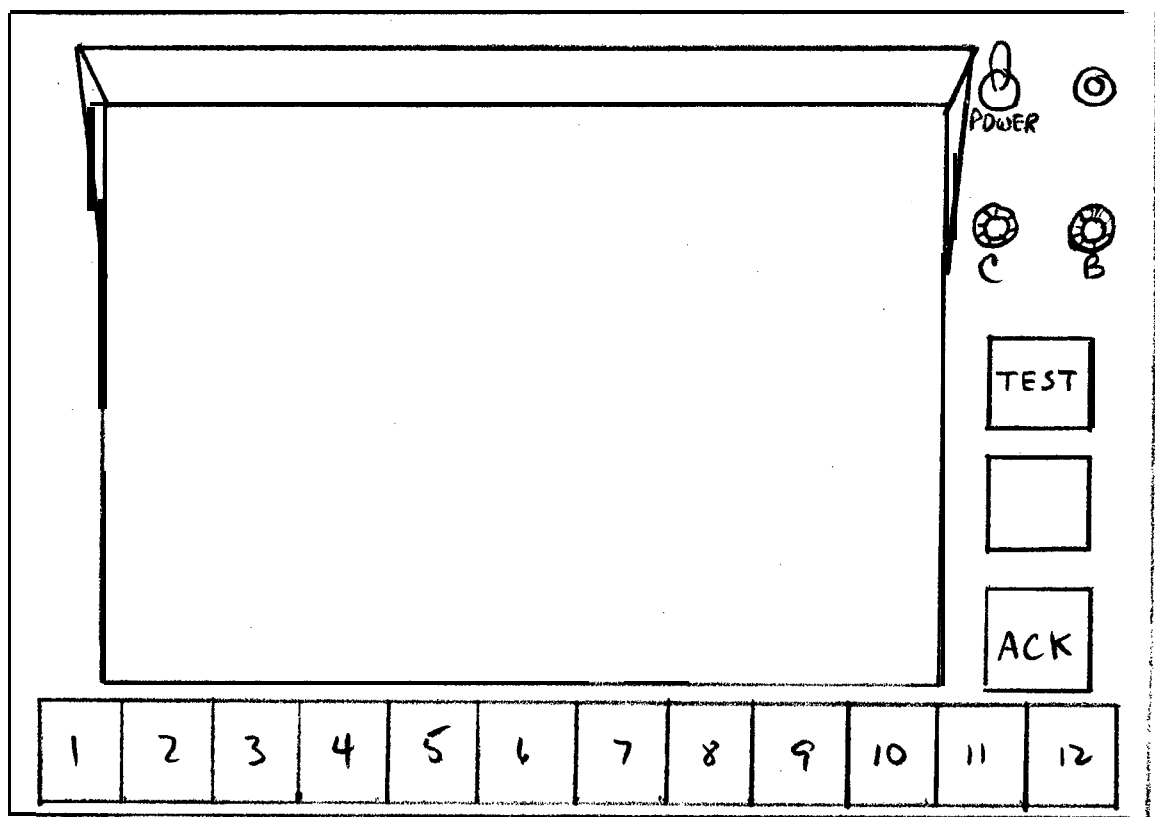 1              TT:TT:TT AAAA WWW WW WW A
 2              RR1VALARM FIELDRVR1TRVR1MRVR1RS#
 3              RR2VALARM FIELDRVR2TRVR2MRVR2RS#
 4              RR3VALARM FIELDRVR3TRVR3MRVR3RS#
 5
 6
 7
 8
 9
10
11
12
13
14
15
16
```

LEGEND

Line 1

    TT:TT:TT = **local time in hours, minutes, seconds (6 numbers plus 2 colons**
    AAAA = **Altimeter setting (4 numbers)**
    WWW WW WW = **wind direction/speed/gust speed (3 numbers/2 numbers/**
       2 numbers)
    A = ATIS **character (1 letter)**

Lines 2, 3, 4

    RR1, RR2, RR3 = **names of runways assigned to this** TRACON **display,**
       e. g. , 12, 26L (3 characters allocated)
    V = Vortex Advisory System number (0-9)
    ALARM FIELD = Alarm fields for assigned runways (11 characters
       allocated)
    RVR#L = RVR **value for assigned runways where L indicates position**
       (T for touchdown, M for Mid, and R for rollout**) and # indicates**
       relative display position of runway (1, 2, 3) (4 numbers and 1 special
       character)
    S# = ALS **or** MALS **light status for assigned runways (letters followed**
       by one number)

Lines 5 through 16

    12 lines of 32 characters each for supplementary data (or lines 1 through
       16 for supplementary data)

Figure 2-6 TRACON Display Data Page Format

```
1              TT:TT:TT AAAA WWW WW WW A
2              RRRVALARM FIELDRVR1TRVR1MRVR1RS#
3              RRRVALARM FIELDRVR2TRVR2MRVR2RS#
4              RRRVALARM FIELDRVR3TRVR3MRVR3RS#
5              .
6
7              .
8              .
9
10             .
11             .
12             RRRVALARM FIELDRVRNTRVRNMRVRNRS#
13             N ##### E ##### SE #####
14             s ##### W #####
15             WX
16             WX
```

LEGEND

Line 1

    TT:TT:TT = **local time in hours, minutes, seconds (6 numbers plus 2 colons)**

    AAAA = **altimeter setting (4 numbers)**

    WWW WW WW = **wind** direction/speed/gust **speed** (3 numbers/2 **numbers**
        2 numbers)

    A = ATIS **character (1 letter)**

Lines 2 through 12

    RRR = **name of runways assigned to all displays, e. g. , 12, 26L
        (3 characters allocated)**

    V = **Vortex Advisory System number** (0-9)

    ALARM FIELD = **alarm fields for assigned runways (11 characters
        allocated)**

    RVR#L = RVR **value for assigned runways where L indicates position
        (T for touchdown, M for Mid, and R for** rollout) **and # indicates
        relative display position of runway (1, 2, 3) (4 numbers and 1 special
        character)**

    S# = ALS **or** MALS **light status for assigned runways (letter followed
        by one number)**

Lines 13, 14

    **Each of these lines represent airport boundaries (2 alphabetic characters)
    and the observed wind at the boundary (3 numbers for** direction/2 **numbers
    for speed), 3 on line** 13, **2 on line** 14.

Lines 15,16

    WX = **weather message (32 characters per line)**

Figure 2-7 Backup Critical Display Data Page Format

Line #	
1	TT:TT:TT AAAA WWW WW WW **A**
2	RRRVALARM FIELDRVR1TRVR1MRVR1RS#
3	RRRVALARM FIELDRVR2TRVR2MRVR2RS#
4	RRRVALARM FIELDRVR3TRVR3MRVR3RS#
5	.
6	
7	.
8	.
9	
10	.
11	.
12	RRRVALARM FIELDRVRNTRVRNMRVRNRS#
13	**N** ##### **E** ##### **SE** #####
14	**s** ##### W #####
15	WX
16	WX

LEGEND

Line 1

TT:TT:TT = **local time in hours, minutes, seconds (6 numbers plus 2 colons)**
AAAA = **altimeter setting (4 numbers)**
WWW WW WW = **wind** direction/speed/gust **speed** (3 numbers/2 **numbers**
2 numbers)
A = ATIS **character (1 letter)**

Lines 2 through 12

RRR = **name of runways assigned to all displays, e. g.,** 12, 26L
(3 characters allocated)
V = **Vortex Advisory System number** (0-9)
ALARM FIELD = **alarm fields for assigned runways (11 characters allocated)**
RVR#L = RVR **value for assigned runways where L indicates position**
(T for touchdown, M for Mid, and R for rollout) **and # indicates**
relative display position of runway (1, 2, 3) **(4 numbers and 1 special character)**
S# = ALS **or** MALS **light status for assigned runways (letter followed by one number)**

Lines 13, 14

Each of these lines represent airport boundaries (2 alphabetic characters)
and the observed wind at the boundary (3 numbers for direction/2 **numbers**
for speed), 3 **on line** 13, 2 **on line** 14.

Lines 15, 16

WX = **weather message (32 characters per line)**

Figure 2-7 Backup Critical Display Data Page Format

CONSOLIDATED CAR DISPLAY/REMOTE
MAINTENANCE MONITOR SYSTEM

FOREWARD

This is Part 3 of a group of specification documents under the basic
heading, "Consolidated Cab Display/Remote Maintenance Monitor System
(CCD/RMMS)," each of which carries the basic number Engineering Requirement
(ER) with a slant line and a number corresponding to the part number.

CONSOLIDATED CAR DISPLAY/REMOTE
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heading, "Consolidated Cab Display/Remote Maintenance Monitor System
(CCD/RMMS)," each of which carries the basic number Engineering Requirement
(ER) with a slant line and a number corresponding to the part number.

Processor - The term processor, as used herein, shall denote a unit containing the following hardware: central processing unit(s), resident memory, and I/O interfaces.

Processor Memory - The resident memory of the processor.

Remote Display/Terminal - A display/terminal capable of accessing the CPS by means of a remote dial-up telephone circuit.

Subsystem Peripherals - These are defined as the CPS operator SMD, disk units, tape unit, and line printer.

3-1.3 Applicable Abbreviations

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
CCD	Consolidated Cab Display
CD	Critical Display
CPS	Central Processing Subsystem
CRT	Cathode Ray Tube
ER	Engineering Requirement
FAA	Federal Aviation Administration
FPU	Facility Processing Unit
GFE	Government Furnished Equipment
ICD	Interface Control Document
ID	Identification
I/O	Input/Output
LCP	Lighting Control Panel
MTBF	Mean-Time-Between-Failure

MTTR	Mean-Time-To-Repair
RMMS	Remote Maintenance Monitor System
SD	Supplementary Display
SMD	Supervisory/Maintenance Display
TD	TRACON Display
TRACON	Terminal Radar Approach Control

3-2 Applicable Documents

3-2.1 Applicable Documents.- The following FAA, military, and miscellaneous documents, of the issued specified in the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

3-2.1.1 FAA Documents

Standard

FAA-STD-018   Computer Software Quality Program

Specifications

FAA-G-1210C   Provisioning Technical Documentation

FAA-G-2100/1   Electronic Equipment, General Requirements

Miscellaneous

NAS-MD-790   Level I Interface Control Document for RMMS

3-2.2.1.2 Military Document

Standard

MIL-STD-461   Electromagnetic Interference Characteristics
                   Requirements for Equipment

MTTR	Mean-Time-To-Repair
RMMS	Remote Maintenance Monitor System
SD	Supplementary Display
SMD	Supervisory/Maintenance Display
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Miscellaneous

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3-2.2.1.2 Military Document

Standard

MIL-STD-461	Electromagnetic Interference Characteristics Requirements for Equipment

material desired, i.e., specification number, dates, amendment numbers,
also, request should identify the invitation for bid, request for
proposals, or the contract involved, or other use to be made of the
requested material.

3-2.3.2 Source of Military **Document.-** Single copies of the military
standard may be obtained from the Naval Supply Depot, **5801 Tabor** Avenue,
Philadelphia, PA, **19120.** Request should cite the request for proposals for
contract for which the standard is needed.

3-2.3.3 Sources of Other **Documents.-** Copies of ANSI documents may be
obtained from the American National Standards Institute, **1430** Broadway,
New York, New York, **10018.** A nominal fee will be charged by ANSI for each
document. Copies of **EIA** publications may be obtained from the Electronic
Industries Association, **2001** Eye Street, **N.W.,** Washington, DC, **20006.**

3-3 Requirements

3-3.1 General.- These requirements are for the Central Processing
Subsystem **(CPS)** which will be an integral part of the Consolidated Cab
Display/Remote Maintenance Monitor System **(CCD/RMMS).** The **CPS** shall
consist of **duplexed** processors, nonvolatile memory, mass storage devices,
basic peripheral units, and all necessary interface hardware.

The **CPS** shall receive sensor type data from several outlying sites via
dedicated and/or shared land lines, process the data, transmit this
processed data to several displays which will be used by operational and
maintenance personnel and record this formatted data with date/time tags on
mass storage for future analysis. In addition, the **CPS** shall have the
capability of transmitting control commands and messages to specific remote
sites for the purpose of performing operational and maintenance functions.
The **CPS** shall be a fail-safe system. Processing of operational software
must not exceed **65** percent of available processor time when running a
maximum site configuration.

3-3.2 Functions.- The **CPS** shall perform the following major functions
on-line and in **real-time:**

        Input/Output

        Real-Time Processing

Data Storage

CPS Integrity Checking

Background Processing

3-3.2.1 Input/Output Function.- The **CPS** shall communicate with the remote sites via message **protocol** and formats in accordance with the Interface Control Document **(ICD)** Level **I.** The processors will be interconnected to validate the performance of each other, and to transmit and receive commands and data. The **CPS** shall communicate with the following categories of displays and display/terminals:

CPS operator's **SMD**

Maintenance **SMD**

Cab and **TRACON SMD**

Critical Displays (CD)

Supplementary Displays (SD)

Lighting Control Panels **(LCP)**

TRACON Displays **(TD)**

Remote and spare display/terminals

Both processors shall communicate with the system peripherals (disks, tape, and the printer).

3-3.2.2 Real-Time Processing Function.- Real-time processing shall be under interrupt control and task scheduling. There shall be a minimum of sixteen **(16)** priority interrupt levels. The executive module of the operational program shall monitor task scheduling on a priority basis. Each task should be scheduled at run time either by the task scheduler or by a hardware priority interrupt. When no interrupt service routine is in execution and no hardware interrupt is pending, the highest priority **noninterruptable** task shall go into execution. A task shall be readied for execution in one of the following ways:

Data Storage

CPS Integrity Checking

Background Processing

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maintenance, etc.). Daily records shall be kept for a minimum of 7 days for the computation of a weekly summary record. The weekly records shall be retained for the period required to compute a monthly summary record. The monthly summary records shall be retained for the period required to compute a quarterly summary record. The quarterly records shall be kept for the period required to generate an annual report.

3--3.2.3.2.6 Maintenance Schedule Record.- The text field shall contain a record type ID and data. The record types are as follows:

> (a) Form -- During operational program generation, maintenance personnel shall create formatted maintenance schedule pages (forms). These form pages shall be loaded into memory and used as field descriptors for user inserted data. Each form page shall be one display page in **composition.**

> **(b)** Data -- The data record shall consist of the inserted data.

3--3.2.3.2.7 Log Record.-- The text field shall contain the user ID and command string entered.

3--3.2.3.3 Magnetic Tape **Storage.--** In order to conserve disk space, the records specified under paragraph **3--3.2.3.2** shall be automatically or manually flushed to tape. The frequency of the automatic task shall be a parameter, modifiable by the **CPS** operator.

3--3.2.4 CPS Integrity Checking Function.- There shall be two modes of **CPS** integrity checking, internal and external.

3--3.2.4.1 Internal Integrity **Checking.--** The processors shall perform the following self-checks:

> (a) Subroutine Execution Time Outs -- Subroutine execution shall be performed in a specific amount of time.

> **(b)** Memory Checks -- Memory reads, writes, and timing shall be validated.

> **(c)** Input/Output Checks -- Reads/writes shall be monitored to all I/O ports, controllers, and peripherals.

3-3.2.4.2 External Integrity **Checking.-** Each processor shall monitor the integrity of the other processor by periodically initiating tasks to validate at least 90 percent of the other processor's performance capability.

3-3.2.5 Background Processing Function.- The **CPS** shall execute, as a minimum, the following functions in a lower priority mode of execution (background):

      (a) Operational Program Generation

      (b) Trend Analysis

      (c) Fault Isolation

      (d) Report Generators

      (e) Maintenance Monthly Schedule

      (f) System and Peripheral Diagnostics

      (g) **CPS** and Remote Site Program Development

      (h) Event Reconstruction

3-3.3 Hardware.- The basic computing element within the **CPS** shall consist of a general purpose computer that is a part of a broad product line in which off-the-shelf peripherals and interface exist and upward compatible hardware and software are available. This general purpose computer (processor) along with the associated peripheral equipment, are described in the following paragraphs.

3-3.3.1 Processor **Requirements.-** Hardware requirements of the processor are contained in the following paragraphs.

3-3.3.1.1 General.- General requirements for the processor are as follows:

      (a) Instruction Repertoire: Bit and byte manipulation, shift, **arithmetic,** and logical instructions, jump, branch, and hardware multiply and divide.

      (b) Instruction Timing: Must conform to industry standards for minicomputers or better.

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    (e) Maintenance Monthly Schedule

    (f) System and Peripheral Diagnostics

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    (a) Instruction Repertoire: Bit and byte manipulation, shift, **arithmetic,** and logical instructions, jump, branch, and hardware multiply and divide.

    (b) Instruction Timing: Must conform to industry standards for minicomputers or better.

Processor self-checks shall be performed by both units by which better than 95 percent of all processor failures must be detectable. Each processor shall perform integrity checks which shall include the following:

(a) Watchdog timer updating. Timer runout will signal switch-over.

(b) Memory check.

(c) Interrupt servicing check.

3-3.3.1.3 Memory.- The working storage shall be random access memory. The storage area required for the maximum site configuration version of the operational software and for data storage shall not exceed 75 percent of the available memory, thus providing for future growth. The minimum acceptable memory requirements are as follows:

(a) Size shall be 64K words expandable to 128K words, with a minimum word length of 16 bits. Modular increments of 16K words minimum shall be available for expansion purposes.

(b) The memory shall be non-volatile during a primary power outage for a minimum of 1 hour. If solid-state memories are proposed, the batteries, if used required to meet the non-volatility requirement shall be a non-acid type.

(c) Read/write cycle time shall be less than 1.5µsec.

(d) Byte addressable in one memory cycle.

(e) Multi-level indirect addressing.

(f) Memory parity checking.

(g) Memory protect to permit partitioning memory.

3-3.3.1.4 Input/Output.- The data rates for the various displays and display/terminals shall be software or switch selectable and the minimums are as follows:

(a) CPS operator   1200 bits/second

(b) Maintenance SMD   1200 bits/second

(c) Cab and TRACON SMD   1200 bits/second

(d) Remote (auto/answer) and spare   300 bits/second
     ports

(e) Critical displays   *

(f) Supplementary displays   *

(g) TRACON displays   *

*As specified in Part 2 of the ER.

3-3.3.1.5 Remote Site and Display Interfaces.- Data communications will
exist between the CPS and remote sites. These communications will be via
dedicated and/or shared land lines into data multiplexers in the CPS having
a maximum data rate of 4800 bits/second. All data communications between
the CPS and remote sites shall be RS-449/232C compatible in accordance with
EIA-RS-232C, EIA-RS-449, and EIA-Bulletin #12.

Data communications with the display subsystem shall be as necessary to
support the requirements of Part 2 of the ER.

3-3.3.1.6 Processor Front Panel.- As a minimum, the front panel of each
processor shall contain an on/off switch, a bootstrap loader key, panel
displays, and entry devices (switches or keys) which can be used to display
and modify the contents of all registers and memory locations. The on/off
switch shall have a lock position to inhibit front panel entry during
program execution.

3-3.3.2 Subsystem Peripheral Equipment Requirements.- The subsystem
peripheral equipment shall be off-the-shelf devices, interface with both
processors and function under program control. The requirements for these
equipments are as follows:

     (a) CPS Operator SMD - The CPS operator SMD will be the basic
     input/output device for the CPS. This terminal shall consist of a
     keyboard and CRT type display. It shall be interchangeable with
     other SMDs in thesystem (i.e., maintenance SMD) and use an

(a)	CPS operator	1200 bits/second
(b)	Maintenance SMD	1200 bits/second
(c)	Cab and TRACON SMD	1200 bits/second
(d)	Remote (auto/answer) and spare ports	300 bits/second
(e)	Critical displays	*
(f)	Supplementary displays	*
(g)	TRACON displays	*

*As specified in Part 2 of the **ER.**

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3-3.3.2 Subsystem Peripheral Equipment Requirements.- The subsystem peripheral equipment shall be off-the-shelf devices, interface with both processors and function under program control. The requirements for these equipments are as follows:

> (a) **CPS Operator SMD** - The **CPS** operator **SMD** will be the basic input/output device for the **CPS.** This terminal shall consist of a keyboard and CRT type display. It shall be interchangeable with other **SMDs** in thesystem (i.e., maintenance **SMD)** and use an

of the central or site(s) software. If more than one editor is provided,
ease of editing should be enhanced through commonality in the editing
commands. The editor(s)' features shall include, but not be limited to,
the following:

      (a) String manipulation - search, change, add, and delete.

      (b) Line manipulation - insert, add, and delete.

      (c) Pointer positioning - forward and backward.

      (d) Auto retrieval of next block of source code from file into edit
      buffer.

      (e) Save the present contents of the scratch file and remain in the
      editor.

3-3.4.1.2 Assembler(s) and Compiler(s).- An assembler and compiler shall
be provided for all languages used in the development of the central and
site(s) software. The **CPS** shall have the capability to develop and modify
software and burn proms for any of the remote sites. If the programming
language(s) of the site's software is not directly compatible with the **CPS,**
then either all necessary cross-assembler(s) and cross-interpreter(s) shall
be provided on the **CPS,** or a remote site's microprocessor development
system shall be provided with all software being directly accessible by the
CPS.

3-3.4.1.3 Loader(s).- A firmware bootstrap loader shall be supplied. The
bootstrap loader shall read the device code of the external device from
which to load, from the front panel switches. A linking loader(s) shall be
supplied which shall create a memory load file. The linking loader shall
provide, but not be limited to, the following:

      (a) Linking absolute and relocateable code.

      (b) Acceptance of external references.

      (c) Linking of subprograms written in any of the supplied
      languages. (Mixing of assembler and **compiler** generated code must be
      possible at load time.)

      (d) A load map defining all global and external references (listing
      of the load map shall be optional).

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(a) String manipulation - search, change, add, and delete.

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(d) A load map defining all global and external references (listing of the load map shall be optional).

3-3.4.2.1 Operational **Program**.- The following software description is functional in nature. If the contractor deviates from a particular approach, an equivalent or better method shall be justified. The capability shall be provided to boot the operational program from both disk and tape. The operational program shall be designed so that inoperative peripherals shall not hinder the primary performance of the **CPS.** The operational program shall perform the following primary functions:

(a) Teleprocessing between the remote sites and the **CPS** according to the **ICD** Level I specification. Fast scan the remote sites for alarms and messages waiting to be transmitted to the **CPS.** Poll the remote sites periodically for status and certification type data. Upon maintenance personnel command, poll a specific site or **subsite** for status and/or certification type data. Transmit messages and commands to the remote sites.

(b) Format incoming data from the remote sites to be sent to the displays and recorded on disk. Format outgoing messages to the remote sites and subsites.

(c) Process alarms from the remote sites on a priority basis.

(d) Route updated data pages (updated by data received from the remote sites or manually entered from a **SMD)** to the appropriate displays.

(e) Update time on the operational displays (critical displays, backup critical display data page of the supplementary displays, and **TRACON** displays), once a second.

(f) Monitor the lighting control panels. Transmit to the remote lighting sites all functions to be performed in a high priority mode. Update data pages, record on disk all changes in intensity levels, and send acknowledge message to appropriate **LCP** upon verification of action performed from the remote site.

(g) Execute and log (with display ID **and/or user** ID) **all control** commands/requests entered from displays and **SMDs.**

(h) Record on disk and display on the appropriate **SMD(s)** all error messages.

(i) Monitor and initiate all requests to execute support programs.

(j) Perform integrity self-checks. Upon fault detection, display appropriate error message(s) and if active, initiate an automatic transfer.

(k) Automatically or upon operator request, flush the data stored on disk to tape.

(m) Provide security procedures and verification for user log-on and disk file access.

(n) Provide a task scheduler for prioritized execution of tasks.

(p) Provide peripheral equipment control.

(q) Perform initialization during inital system startup, power fail/auto restart, and fail-safe/processor transfer.

(r) Provide manual processor transfer capability.

(s) Perform baseline test functions.

The following primary modules shall be part of the operational program:

3-3.4.2.1.1 Executive.- The executive module shall control general processing, housekeeping and bookkeeping, peripheral equipment control, access and timing of information flow, error reporting, interrupt vectoring, system security, and task scheduling.

3-3.4.2.1.1.1 General Processing.- General purpose routines shall be part of the executive module.

3-3.4.2.1.1.2 Housekeeping and Bookkeeping.- A log shall be kept on disk of all user commands that affect system operation and performance (see paragraph 3-3.2.3.2.7).

3-3.4.2.1.1.3 Peripheral Equipment Control.- Software control of the peripheral equipment is described in the following two paragraphs.

3-3.4.2.1.1.3.1 Subsystem Peripherals.- The CPS shall provide continuous data recording and dump the data disk to tape in accordance with paragraph 3-3.2.3.3, or when the data disk if full. If the tape unit is inoperative, the CPS shall overflow the data to the data area on the system disk. The capability shall also exist to perform the disk to tape dump function manually at the CPS operator's request.

The **CPS** operator **SMD,** disk drives, tape drives, and line printer shall be addressed as fixed function data ports.

3-3.4.2.1.1.3.2 User Peripherals.- The critical displays, supplementary displays, and **TRACON** displays shall be addressed as fixed function data ports, while the cab **SMD, TRACON SMD,** maintenance **SMD,** and remote and spare display/terminal ports shall be assigned a function capability according to user ID and password entered when logging on the system. All displays and display/terminal shall be discretely addressed. There shall be a time-out feature for the remote display/terminal (auto/answer) passive user. If a response is not received from the remote display/terminal within 5 minutes, the **CPS** shall disconnect the remote display/terminal.

The remote sites shall be addressed by site and **subsite** ID in accordance with **ICD** Level I.

3-3.4.2.1.1.4 Access and Timing of Information Flow.- The executive module shall control information flow through the system. Data updates and modifications shall be performed by priority. A normal or test mode of operation shall be established by means of an operator command. Data acquisition during the normal mode of operation shall be from remote sites. During the test mode (baseline testing) of operation, data acquisition shall be from a disk or tape file.

3-3.4.2.1.1.5 Error **Reporting.-** The executive module shall direct error messages to the appropriate **SMD(s)** on a priority basis. Error messages shall be in English language form.

3-3.4.2.1.1.6 Interrunt **Vectoring.-** The executive module shall vector interrupts at the same interrupt level to the appropriate service routines. There shall be a minimum of sixteen **(16)** interrupt levels.

3-3.4.2.1.1.7 System **Security.-** Access to the system shall be limited. Only users with the proper user identification (user ID) and valid password shall be allowed to enter the system. The identification codes and passwords will be changed by the **CPS** operator periodically to prevent unauthorized entry to the system. A log shall be kept of user ID, connect time, disconnect time, and control commands entered for all users on the system. There shall be disk file protection and memory partitioning.

3-3.4.2.1.1.8 Task **Scheduling.-** A task scheduler shall be part of the executive module. The task scheduler shall control the execution order

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3-3.4.2.1.2.3 Fail-Safe/Processor Transfer.- The active processor shall request an auto transfer and send the reason for transfer to the other processor, when any of the following conditions occur:

(a) The heat temperature sensor in the active processor detects an out-of-tolerance condition.

(b) The active processor detects communication or I/O problems.

(c) The active processor detects memory faults.

(d) The active processor detects execution faults.

The other processor **will intiate** an auto transfer when it detects a fault in the active processor performance.

Both an automatic and manual transfer capability shall be provided. When a processor transfer occurs, either automatically or manually, a message **describing** the processor transfer as auto or manual, active processor or externally invoked, and the reason for the transfer shall be displayed at the **CPS** operator **SMD** and recorded on disk.

3-3.4.2.1.3 Teleprocessing.- The **CPS** shall maintain a communications link with all remote sites for the purpose of collecting status and certification type data. The **CPS** shall also have the capability of transmitting command messages to the remote sites via shared or dedicated land lines. These communication line configurations may be either point-to-point or multipoint modes. The protocols necessary for establishment, polling, selection with response, fast selection, message transfer, termination, aborts, interrupts, and recovery procedures shall conform to, but not be limited to, the ANSI Publication **X3.28-1976,** "Procedures for the Use of the Communication Control Characters of the American National Standard Code for Information Interchange in Specified Data Communication Links". The communication links shall use the following data communication procedures as specified in **ICD** Level I.

(a) Character-oriented, code transparent data link procedures. These procedures shall comply with two-way alternate, non-switched multipoint with centralized operation and selection. Response to selection shall use **message** independent blocking, with cyclic checking, alternating acknowledgment, and transparent heading and text.

(b) Character-oriented, non-code transparent data link procedures. These procedures shall comply with two-way alternate, switched point-to-point using conversational message transfer.

(c) Bit-oriented data link procedures. These procedures shall comply with the ANSI **BSR X3.66-1977** Standard.

3-3.4.2.1.4 Remote Site **Handler.-** A remote site detecting its assigned polling supervisory sequence assumes master status and responds in one or two ways:

(a) If the station has a message to send, it initiates messages transfer. The active processor assumes slave status.

(b) If the remote site has no message to send, it sends **EOT,** terminating its master status. Master status then reverts to the active processor. Two types of polling requests will be generated by the active processor. The first one is a specific polling request to establish line continuity and for alarm messages only, and the second is a general polling request. Polling requests may be addressed to either a remote site or **subsite.**

3-3.4.2.1.5 Formatter.- The formatter module shall be created, during the operational program generation, according to the types of remote sites in the system. A subroutine shall be appended to the formatter module for each type of remote site. The functions of the subroutine shall be to format incoming data from the remote site and route the formatted data to memory locations and disk, and to format outgoing messages to the remote site.

3-3.4.2.1.6 Display **Subsystem.-** The display subsystem shall consist of the following:

Critical Displays (CD)

Supplementary Displays (SD)

Lighting Control Panels **(LCP)**

TRACON Display **(TD)**

Cab and **TRACON** Supervisory/Maintenance Displays **(SMD)**

(b) Character-oriented, non-code transparent data link procedures. These procedures shall comply with two-way alternate, switched point-to-point using conversational message transfer.

(c) Bit-oriented data link procedures. These procedures shall comply with the ANSI BSR X3.66-1977 Standard.

3-3.4.2.1.4 Remote Site **Handler.-** A remote site detecting its assigned polling supervisory sequence assumes master status and responds in one or two ways:

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Supplementary Displays (SD)

Lighting Control Panels **(LCP)**

TRACON Display **(TD)**

Cab and **TRACON** Supervisory/Maintenance Displays **(SMD)**

Upon logging on the system, the user shall enter a user ID and password. According to the user ID and password entered, the system shall acknowledge the remote or spare display/terminal user as one of the following three types of users:

   (a) Passive User - A passive user shall not have any control capability and shall be a low priority on the system. The passive user may request all data pages stored within the CPS and shall be transparent to the CPS.

   (b) Cab and TRACON SMD - The user logs on as the cab or TRACON SMD user, and shall have the full command capability of a cab or TRACON SMD position.

   (c) Maintenance SMD - The user logs on as the maintenance SMD user, and shall have the full command capability of the maintenance SMD position.

In all three modes of operation, the capability to send and receive messages to and from the CPS operator SMD shall be provided.

3-3.4.2.1.9 CPS Operator SMD.- The CPS operator shall have complete control of the central processing subsystem and be capable of performing the following functions:

   (a) Manually switch operational program execution between processors.

   (b) Perform program development (edit, compile, assemble, link, etc.), in a background mode of operation.

   (c) Execute background routines, as low priority task, such as: operational program generation, trend analysis, fault isolation, report generators, peripheral diagnostics, etc.

   (d) Execute the commands of a maintenance or cab/TRACON SMD for debugging purposes.

   (e) Change, add, or delete user ID's and passwords for security purposes.

   (f) Manually flush the disk data to tape.

   (g) Perform conversational input/output with the operational program such as modifying operational parameters, disabling subsystem peripherals, etc.

3-3.4.2.1.10 Background Control.- The background control module shall
control user requests to execute support programs in the background mode.

3-3.4.2.2 Processor Integrity Checker Program.- The processor integrity
checker program shall execute on the CPS in a real-time high priority mode
of operation, and continuously validate the performance of the active
processor. If externally a fault is detected in the performance of the
active processor, an autotransfer shall be initiated. An error message
shall be displayed on the CPS operator's SMD, that an autotransfer was
initiated and the reason for the transfer. If the active processor
internally detects a fault, the active processor shall transmit an error
code to the other processor describing the reason for the transfer. An
autotransfer shall be executed and the other processor shall display an
error message on the CPS operator's SMD, that an autotransfer was initiated
by the active procesor and the reason for the transfer (see Section
3-3.4.2.1.2.3).

3-3.4.2.3 Support Programs.- The support programs to be executed in a
background mode of operation are described in the following paragraphs.

3-3.4.2.3.1 Operational Program Generation.- This routine will allow the
CPS operator to configure the operational program according to the remote
sites and display subsystem configuration. The routine shall perform, as a
minimum, the following functions:

    (a) Build the formatter module, based on the type of remote sites
    in the system.

    (b) Assign remote site multiplexer channel numbers and data rates
    with remote site identifiers and subidentifiers.

    (c) Set initialization parameters to default values by manual entry
    or by reading in a disk file (both capabilities shall be provided).

    (d) Assign display addressing codes and data rates to specific
    types of displays, SMDs, and display/terminals.

    (e) Assign user ID's and passwords.

    (f) Establish the default formats of the operational displays and
    maintenance SMD data pages by reading in disk files.

3-3.4.2.1.10 Background Control.- The background control module shall control user requests to execute support programs in the background mode.

3-3.4.2.2 Processor Integrity Checker Program.- The processor integrity checker program shall execute on the **CPS** in a real-time high priority mode of operation, and continuously validate the performance of the active processor. If externally a fault is detected in the performance of the active processor, an autotransfer shall be initiated. An error message shall be displayed on the **CPS** operator's **SMD,** that an autotransfer was initiated and the reason for the transfer. If the active processor internally detects a fault, the active processor shall transmit an error code to the other processor describing the reason for the transfer. An autotransfer shall be executed and the other processor shall display an error message on the **CPS** operator's **SMD,** that an autotransfer was initiated by the active **procesor** and the reason for the transfer (see Section **3-3.4.2.1.2.3).**

3-3.4.2.3 Support **Programs.-** The support programs to be executed in a background mode of operation are described in the following paragraphs.

3-3.4.2.3.1 Operational Program Generation.- This routine will allow the **CPS** operator to configure the operational program according to the remote sites and display subsystem configuration. The routine shall perform, as a minimum, the following functions:

> (a) Build the formatter module, based on the type of remote sites in the system.
>
> **(b)** Assign remote site multiplexer channel numbers and data rates with remote site identifiers and subidentifiers.
>
> **(c)** Set initialization parameters to default values by manual entry or by reading in a disk file (both capabilities shall be provided).
>
> **(d)** Assign display addressing codes and data rates to specific types of displays, **SMDs,** and display/terminals.
>
> **(e)** Assign user ID's and passwords.
>
> **(f)** Establish the default formats of the operational displays and maintenance **SMD** data pages by reading in disk files.

The maintenance SMD operator shall have the capability to obtain a hard copy of the maintenance schedules.

3-3.4.2.3.7 CPS and Remote Site Program Development.- All necessary software to perform program development for both the central and remote sites shall be supplied such as:

(a) Editor(s)

(b) Assembler(s)/Cross-Assembler(s)

(c) Complier(s)/Cross Compiler(s)

(d) Interpreter(s)

(e) Loader(s)

(f) Debugger(s)

3-3.4.2.3.8 Event Reconstruction.- The capability shall be provided to perform event reconstruction. The event reconstruction software shall be executed on command from the CPS operator SMD. The CPS operator shall enter the time period of the data to be reconstructed, the display address (code) on which the data *was* originally displayed, and the display or SMD address (code) on which to display the reconstructed data. The software shall provide the capability to perform *event* reconstruction in real-time, fast-time, and slow-time (including freeze). The execution of the event reconstruction software shall not hinder the exection of the operational program.

3-3.4.2.4 Baseline Test **Program.**- The baseline test program shall be executed in conjunction with the operational program. Upon operator command, under the operational program, the baseline test program will be overlayed.

The function of the baseline test program is to receive simulated data from a disk or tape file (both capabilities shall be provided) in order to exercise those functions of the operational program selected by the CPS operator.

3-3.5 CPS Characteristics

3-3.5.1 Subsystem Performance.- The CPS shall meet the functional and performance requirements of this ER when properly installed and operated

in accordance with procedures to be developed. Several important performance features are as follows:

(a) Following processor transfer or a power fail/restart, the CPS shall update the critical displays within 5 seconds and all other displays within 30 seconds.

(b) When performing a system startup, manual data entry shall be kept to a minimum. A command file approach shall be taken.

(c) Self-checks shall be performed by both processors with at least 95 percent of all failures being detectable.

(d) Processor memory shall withstand a primary power outage of at least 1 hour.

(e) The time duration from when a remote site senses an alarm until the information is displayed on the critical displays, shall be a maximum of two (2) seconds for an ILS alarm and a maximum of five (5) seconds for all other alarms.

3-3.5.2 Reliability and Maintainability.- The reliability and maintainability requirements specified herein shall apply to the equipment within the CPS.

3-3.5.2.1 Processor Reliability and Maintainability.- Each of the processors shall have a specified Mean-Time-Between-Failures (MTBF) of 1000 hours (excluding indicator lamps, fuses, etc.). The Mean-Time-To-Reair (MTTR) shall be 1 hour or less (based upon these values and utilizing the equation $\frac{U^2}{16}$ (for repairable redundant systems), the duplexed processors will have a theoretical mean up-time of 500,000 hours).

3-3.5.2.2 Peripheral Equipment Reliability and Maintainability.- The subsystem peripheral equipment associated with the CPS shall meet the following requirements.

(a) Disk Unit - The minimum acceptable MTBF shall be 4000 hours with an MTTR of 1 hour or less.

(b) Tape Unit - The minimum acceptable MTBF shall be 2000 hours with an MTTR of 1 hour or less.

(c) Line Printer Unit - The minimum acceptable MTBF shall be 2000 hours with an MTTR of 1 hour or less.

in accordance with procedures to be developed. Several important performance features are as follows:

(a) Following processor transfer or a power fail/restart, the **CPS** shall update the critical displays within 5 seconds and all other displays within 30 seconds.

(b) When performing a system startup, manual data entry shall be kept to a minimum. A command file approach shall be taken.

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(d) Processor memory shall withstand a primary power outage of at least 1 hour.

(e) The time duration from when a remote site senses an alarm until the information is displayed on the critical displays, shall be a maximum of two **(2)** seconds for an **ILS** alarm and a maximum of five **(5)** seconds for all other alarms.

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3-3.5.2.2 Peripheral Equipment Reliability and Maintainability.- The subsystem peripheral equipment associated with the **CPS** shall meet the following requirements.

(a) Disk Unit - The minimum acceptable **MTBF** shall be 4000 hours with an **MTTR** of 1 hour or less.

(b) Tape Unit - The minimum acceptable **MTBF** shall be 2000 hours with an **MTTR** of 1 hour or less.

(c) Line Printer Unit - The minimum acceptable **MTBF** shall be 2000 hours with an **MTTR** of 1 hour or less.

indicate correct or incorrect operation for that specific major unit.
Errors detected in the course of performance testing shall be displayed on
the CPS operator SMD and optionally routed to the line printer.

3-3.5.2.3.3.1 Indicator **Lights.-** Lights used as indicators of equipment
status or performance shall be located on front panels, and shall be
readily replaceable.

3-3.5.2.4 Special Tools and Special Test Equipment.- The design shall
emphasize the use of commercially available tools, test equipment, and
fixtures for maintenance aids and minimize reliance upon special equipment.
However, any special tools and special test equipment necessary for the
repair, adjustment, test, and maintenance of the subsystem specified
herein, shall be supplied as part of the equipment.

The contractor shall submit for FAA review and approval, a complete list of
special tools and special test equipment, the application and procedures
for use of each, and the unit or component for which it is required. **This**
data and information shall be submitted prior to fabrication or procurement
of any special tools and special test equipment. Contracting Officer
approval is required prior to such fabrication or procurement of these
items.

3-3.5.2.5 Standard Test Equipment.- An itemized list of standard
commercially available test equipment, required for maintenance of the
subsystem shall be provided to the Contracting Officer by the contractor in
accordance with paragraph **3.13.1** of **FAA-G-1210C.** This list shall indicate
the make and model of each item.

3-3.5.2.6 Reliability **Progra.-** It is the intent of the government to
establish a limited reliability program for the **CPS.** This program will be
contained in the overall Reliability Program Plan detailed in Part 1 of
this **ER.**

3-3.6 Design and Construction

3-3.6.1 General **Requirements.-** The **CPS** shall be designed to provide high
operational availability and good accessibility for maintenance and repair
or replacement of units, components, and circuits. Each subassembly shall
be removable from the cabinets without requiring the partial or complete
removal of any other subassembly. The cabinets shall be of high quality,
sturdy construction, and be accurately and carefully fabricated. All
cabinet assemblies shall be designed so that it shall not be necessary to
bolt or fasten down the equipment. Adjustable leveling pads shall be

provided at each corner of the cabinet base, having sufficient travel to unload casters underneath the cabinet if casters are used. All equipment access door shall be capable of being easily removed and reinstalled.

Latches shall be provided to hold cabinet doors in the open position. Doors and panels shall be adequately braced and removable units shall be of sufficiently small size and weight so as to not exceed 50 pounds (22.65 kilograms) to permit removal and replacement by one unassisted technician. Removal of units for maintenance or repair or for interchanging of units shall not cause any deformation to the cabinet or to the units. Where equipment cabinet lifting devices, such as hooks or rings, are installed for convenience in handling, such devices shall be replaced by the contractor with suitably painted cap bolts to be installed after removal of such hooks or rings. All cables and wires, harnessed or single, shall be protected against chafting, and such protection shall be independent of the individual wire or cable insulation or jacket. All surfaces of items on the front of panels shall be at cabinet ground potential. Cabinets shall be designed for installation side by side. The various units or modules mounted in each cabinet shall be accessible for servicing from either front or rear. These units shall be provided with slides where necessary to permit withdrawal for servicing and where components or test points are only accessible from the bottom, a suitable tilt or hinge arrangement shall be provided to permit easy and comfortable accessibility.

Equipment cabinets shall be no greater than seventy-six (76) inches (193 cm) in height (excluding trve of leveling pads), thirty-two (32) inches (81 cm) wide, and thirty (30) inches (76 cm) deep. These dimensions exclude cable ducts and input/output connectors. Such external front and rear protrusions may extend an additional two (2) inches (5 cm) normal to the cabinet surface. Maximum floor loading of any cabinet shall be less than 200 pounds per square foot (975 kilograms per square meter).

The design and construction of the CPS cabinets shall be subject to FAA acceptance.

3-3.6.2 Color of **Finishes.-** The basic color and accent panel colors shall be as specified by the Contracting Officer from the colors normally offered by the manufacturer.

3-3.6.3 Cabinet Ventilation and Cooling.- All blowers, vents, and cooling equipment necessary for the ventilation and cooling of the equipment shall

provided at each corner of the cabinet base, having sufficient travel to unload casters underneath the cabinet if casters are used. All equipment access door shall be capable of being easily removed and reinstalled.

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All cables shall be supplied with connectors installed. Any special tools and instructions required for cable fabrication shall be furnished by the contractor as special test equipment.

3-3.6.7.1 Cable Entrance and Exit Locations.- Cable entrances and exits shall be designed such as to enable advantageous routing of the cables between units from the standpoint of accessibility, noninterference with operating personnel, and appearance of installed equipment.

3-3.6.8 Components and Materials.- All subassemblies, components, and materials shall be as specified in 1-3.3.1.10.

3-3.6.9 Service Conditions.- The equipment herein shall perform in accordance with the requirements of this ER under the service conditions listed below. The equipment will be contained within an attended facility and the normal ambient temperature of the environment in which the equipment will be installed will be 72 degrees Fahrenheit (22 degrees Celcius). Service conditions including AC line parameters, are as follows:

Operating (Power On)

(a) 0-10,000 feet (0-3048 meters) altitude above sea level.

(b) 50-90 degrees Fahrenheit (10-32 degrees Celsius) temperature ambient (cabinet intake air temperature).

(c) 20 percent - 80 percent relative humidity.

(d) Direct air conditioning shall not be required.

(e) AC line parameters:

Design Center	Range
120 volts	108-132 volts
208 volts	187-229 volts
60 Hz	57-63 Hz

* Exception is disc drive units where accuracy is 59-61Hz.

3-3.6.10 Electrical Service Conditions

3.3.6.10.1 Transient State.- All equipment shall perform its specified function in accordance with the requirements of 1-3.3.4 and 1.3.3.5 of

FAA-G-2100/1 pertaining to AC power source transients. No false
operational or input signals shall be generated by transients within the
defined limits or by inrush currents caused by the CPS.

3-3.6.10.2 Startup Surges.- The peak inrush current during startup shall
not exceed five times the normal peak operating current.

3-3.6.11 Electrical Design.- The electrical design of the system shall
minimize total electrical power consumption and be in accordance with best
commericialpractices. Convenience twin outlets in accordance with 1-3.6.4
of FAA-G-2100/1 shall be provided on the front and/or rear of each
processor cabinet for 120-volt AC test equipment, soldering irons, etc.
These outlets shall be powered from an electrically separate power cable
brought out of the cabinet for connection to a separate noncritical AC
power source. The ground terminal of all convenience outlets shall be
electrically isolated from the equipment cabinet and connected by a green
insulated conductor to the ground terminal in the power distribution panel
serving the outlet.

3-3.7 Documentation.- Documentation required under the contract shall be
as specified in Part 1 of the ER and as specified in the following
paragraphs. Documentation detailed under Part 1 of the ER applies to all
parts of the CCD/RMMS while the documentation detailed in the following
paragraphs specifically relates to the CPS.

The contractor may utilize existing material or material that may contain
the required information within an existing document. Submission and
approval of documentation material shall be in the quantities and in
accordance with the schedule specified in the contract. Updating of the
required documentation shall be accomplished periodically to maintain the
documentation in current status.

3-3.7.1 Central Software Design Data.- This design documentation shall
provide overall information about the central software package and shall
include, as a minimum, a functional specification and design specification
in accordance with Part 1 of the ER.

3-3.7.2 Computer Program Documents.- The contractor shall provide all
documentation necessary for FAA to maintain and modify all deliverable
computer programs. The organization of all documentation shall be complete
and conform to accepted program documentation practices. Where flow charts
occur within the documentation, all symbols used shall conform to

ANSI standards. As a minimum, the software documentation shall include the items described in the following paragraphs. These documents shall be reviewed and approved by the government, and quantities supplied in accordance with the contract schedule.

3-3.7.2.1 Operational Program Documentation.- The operational program documentation shall include a program manual and an operator's manual.

3-3.7.2.1.1 Program Manual.- In accordance with the contract schedule, an operational program manual shall be furnished which provides an overview of all routines and their interrelationships to the hardware and shall describe how the functional requirements of the system were met. It shall also provide logical flow charts, and source listings for each subprogram described. The source listings shall present the final delivered software and contain sufficiently detailed comments to adequately describe the purpose of each subfunction. The manual shall provide a sufficient detail to allow FAA personnel to make program modifications. The manual shall include, but not be limited to, the following:

(a) The manual shall specify the procedures for updating the manual and identify the relationship of this manual to the other software documents.

(b) The manual shall provide a detailed explanation of conventions adopted within the operational program with respect to flow charting, table names, data names, routing labels, and calling sequences.

(c) The manual shall provide a detailed explanation of hardware related programming factors such as input/output formats, codes, bit arrangements for control characters, communication sequences, interrupt processing, and task priority scheduling.

(d) The manual shall describe how adaption parameters are modified.

(e) The manual shall provide for such subprogram within the operational program, a narrative description, specification of the program inputs and outputs and their definitions, system functions performed, and the specific methods employed. The contractor shall provide specifications in this section showing table definitions, storage allocation, and identification of reserved registers.

3-3.7.2.1.2 Operator's Manual.- The operator's manual shall provide the information necessary to execute the operational program. It shall clearly describe the relationship of the manual to other program documentation,

ANSI standards. As a minimum, the software documentation shall include the items described in the following paragraphs. These documents shall be reviewed and approved by the government, and quantities supplied in accordance with the contract schedule.

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> (a) The manual shall specify the procedures for updating the manual and identify the relationship of this manual to the other software documents.

> **(b)** The manual shall provide a detailed explanation of conventions adopted within the operational program with respect to flow charting, table names, data names, routing labels, and calling sequences.

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> **(e)** The manual shall **provide** for such subprogram within the operational program, a narrative description, specification of the program inputs and outputs and their definitions, system functions performed, and the specific methods employed. The contractor shall provide specifications in this section showing table definitions, storage allocation, and identification of reserved registers.

3-3.7.2.1.2 Operator's Manual.- The operator's manual shall provide the information necessary to execute the operational program. It shall clearly describe the relationship of the manual to other program documentation,

(b) Internal data structure including buffers, tables, flags, and indicators, special labels, and expansion provisions.

(c) Operating instructions.

(d) Program modification and generation procedures including compile/assemble and loading instructions.

(e) Simulated data file modifications procedures.

3.4 Quality Assurance Provisions

3-4.1 General.- General provisions for providing and maintaining a quality control program are detailed in Part 1 of the **ER.** However, specifically within the **CPS,** software quality control shall be provided as described in the following paragraphs.

3-4.2 Computer Software Quality Control and Testing.- The contractor shall establish a system to assure control over the software preparation process in accordance with **FAA-STD-018.**

3-4.2.1 Computer Software Quality Control Program Plan.- The contractor shall prepare and submit for FAA approval, a plan to implement a computer software quality control program plan to assure all software delivered meets contractural requirements. This plan shall be provided in accordance with the contract schedule.

3-5 Preparation for Delivery

See Part 1 of the **ER.**

3-6 Notes

APPENDIX 3-1 TABLE OF CONTENTS

APPENDIX **3-1** TABLE OF CONTENTS

DRAFT

CONSOLIDATED CAB DISPLAY/REMOTE MAINTENANCE MONITOR SYSTEM

FOREWORD

This is Part 5 of a group of specification documents under the basic heading, "Consolidated Cab Display/Remote Maintenance Monitor System (CCD/RMMS)," each of which carries the basic number Engineering Requirement (ER) with a slant line and a number corresponding to the part number.

DRAFT

CONSOLIDATED CAB DISPLAY/REMOTE MAINTENANCE MONITOR SYSTEM

FOREWORD

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"Consolidated Cab Display/Remote Maintenance Monitor System (CCD/RMMS),"
each of which carries the basic number Engineering Requirement (ER) with a
slant line and a number corresponding to the part number.**

Listing of Parts

5-1 S C O P E

5-1.1 Scope of Part 5. - This Part 5 contains the requirements which are applicable alone or in conjunction with other parts of this ER, to the design, fabrication, testing, installation, and field validation of the ILS subsystem of a CCD/RMM system to be installed and operated in FAA terminal facilities. The ILS subsystem consists of a facility processing unit (FPU) for each ILS remote site to be monitored. Each FPU shall be comprised of a microcomputer, data communications unit (modem), status/control interface, and an unterruptable power supply. An FPU makes the determination of the status of ILS monitors at a site (i.e., localizer, glideslope, markers, far field monitor), through the initiation of automatic tests upon monitor discrepancies (in the case of dual monitors) and periodically (for single and dual monitors) for certification type data. The FPU stores and transmits all data available for use at the Central Processing Subsystem (CPS).

5.2 APPLICABLE DOCUMENTS

5-2.1 FAA Specifications and Orders. - The following Orders are applicable to this part of the specification along with those in Part 1:

Listing of Parts

FAA-ER-500-007/1   **Part 1 - General**

FAA-ER-500-007/2   **Part 2 - Display Subsystem**

FAA-ER-500-007/3   **Part 3 - Central Processing Subsystem**

FAA-ER-500-007/4   **Part 4 - Remote Transmitter/Receiver Subsystem**

FAA-ER-500-007/5   **Part 5 - Instrument Landing System Subsystem**

FAA-ER-500-007/6   **Part 6 -** Lighting/RVR Subsys **tern**

FAA-ER-500-007/7   **Part 7 - Tower Interface Subsystem**

5-1 S C O P E

5-1.1 Scope of Part 5. - This Part 5 contains the requirements which are applicable alone or in conjunction with other parts of this ER, to the design, fabrication, testing, installation, and field validation of the ILS subsystem of a CCD/RMM system to be installed and operated in FAA terminal facilities. The ILS subsystem consists of a facility processing unit (FPU) for each ILS remote site to be monitored. Each FPU shall be comprised of a microcomputer, data communications unit (modem), status/control interface, and an unterrupt-able power supply. An FPU makes the determination of the status of ILS monitors at a site (i.e., localizer, glideslope, markers, far field monitor), through the initiation of automatic tests upon monitor discrepancies (in the case of dual monitors) and periodically (for single and dual monitors) for certification type data. The FPU stores and transmits all data available for use at the Central Processing Subsystem (CPS).

5.2 APPLICABLE DOCUMENTS

5-2.1 FAA Specifications and Orders. - The following Orders are applicable to this part of the specification along with those in Part 1:

-3.2 Performance Requirements. - These subparagraphs contain require-
ments applicable to all items for the FPU of the specification.

-3.2.1 Hardware

-3.2.1.1 Microcomputer. - Each microcomputer shall provide the capability
to collect all available data for the ILS site where installed via the status/
control interface. Each microcomputer shall have a serial communications
interface at RS-449/232C levels for the purpose of transmitting and receiving
data from the local terminal, and a serial communications interface at
RS-449/232C levels for the purpose of transmitting and receiving data from
the communications unit. The microcomputer shall contain the hardware
required to perform fault diagnosis upon the ILS equipment at the site. The
microcomputer must be capable of executing all requirements described
elsewhere in this specification, plus 50 percent additional workload. T h e
microcomputer shall use a minimum 8-bit word length. The microcomputer
and all other FPU hardware shall not adversely affect any signal or operation
the ILS equipment, even in the event of FPU hardware failure. The
microcomputer shall contain the necessary hardware/software to accomodate
reinitialization of the software locally and remotely.

3.2.1.1.1 Front Panel. - The microcomputer front panel shall contain
the following features:

    1. Connector for the attachment of a portable terminal (RS-449/232C
compatible).

2. A reset button to reinitialize the software.

3. Maintenance/normal switch.

5-3.2.1.1.2 Memory. - Memory shall consist of a combination of eraseable programmable read only memory (EPROM) and random access memory (RAM). Both RAM and EPROM must be capable of being expanded without the addition of a second chassis, by the greater of 25 percent or 4K words over that required to meet the other requirements specified elsewhere in this specification.

5-3.2.1.1.3 Real Time Clock. - A real-time clock with a minimum resolution of one millisecond, that is under programmable control of the microcomputer, shall be supplied.

5-3.2.1.2 Data Communications Unit (Modem). - The data communications unit shall be a commercially available modem. It shall have an RS-449/232C compatible interface to the microcomputer and shall be capable of transmitting/receiving data at rates up to and including 1200 bps. The modems shall operate from the uninterruptable power supplies (UPS) during power outages. The site modems shall be of the same product line as the modems at the CPS.

5-3.2.1.3 Status/Control Interface. - The status/control interface shall include the sensors and other hardware necessary to monitor and control

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2. A reset button to reinitialize the software.

3. Maintenance/normal switch.

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5-3.2.1.3 Status/Control Interface. - The status/control interface shall include the sensors and other hardware necessary to monitor and control

5-3.2.2.1 RMM **Software.** - The RMM software shall provide the capability to control the ILS equipment and to perform data collection of all available data. It shall perform tests upon this data to determine if faults, alarms, or status changes of any monitored parameter have occurred. Thes e faults, alarms , or status changes shall be transmitted (in accordance with the ICD for RMMS) to the CPS.

In the event of a communications failure between the facility and central site, the software shall continue to collect and test data. During a communications failure, the pre-alarm and alarm data shall be stored and maintained in memory until communications is re-established. The pre-alarm and alarm data shall then be transmitted to the CPS.

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as pre-alarm, alarm, status, or periodic (certification type) data; subcategorized to identify its source. The software shall provide the capability of performing fault diagnosis upon the ILS.

5-3.2.2.1.1 **Initialization Software.** - Software shall be provided to initialize the FPU under any of the following conditions:

1. Initial system startup (power on)

2. Power fail/restart

5-3.2.2.1 RMM **Software.** - The RMM software shall provide the capability to control the ILS equipment and to perform data collection of all available data. It shall perform tests upon this data to determine if faults, alarms, or status changes of any monitored parameter have occurred. These faults, alarms, or status changes shall be transmitted (in accordance with the ICD for RMMS) to the CPS.

In the event of a communications failure between the facility and central site, the software shall continue to collect and test data. During a communications failure, the pre-alarm and alarm data shall be stored and maintained in memory until communications is re-established. The pre-alarm and alarm data shall then be transmitted to the CPS.

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as pre-alarm, alarm, status, or periodic (certification type) data; subcategorized to identify its source. The software shall provide the capability of performing fault diagnosis upon the ILS.

5-3.2.2.1.1 **Initialization Software.** - Software shall be provided to initialize the FPU under any of the following conditions:

1. Initial system startup (power on)

2. Power fail/restart

stored values of all parameters described in paragraph 5-3.2.2.1.3.1. The status and certification type data thus collected shall be transmitted to the local terminal or CPS upon request. Safeguards shall be incorporated to preclude unauthorized or inadvertent alteration of parameters or limits from the local terminal.

5-3.2.2.1.3.1 ILS Certification Type Parameters. - The certification type parameters (5-3.2.2.1.3.1.1, 5-3.2.2.1.3.2, and 5-3.2.2.1.3.1.3) shall be automatically verified for each of the ILS sites (i. e. , localizer, glide-slope, markers, far field monitor), by means of exercising the appropriate interface or other built-in circuitry as required without interruption of normal operation (other than momentary bypass of the monitor, if required). (See FAA Orders 6750.15, 6750.17, and 6700.15.)

5-3.2.2.1.3.1.1 Localizer and Far Field Monitor Parameters. - The following is a list of typical parameters to be monitored (from both monitor 1, monitor 2, and where appropriate, the far field monitor) remotely:

1. CLR on CSE RF

2. CLR on CSE SDM

3. CLR on CSE DDM

4. CLR off CSE DDM

5. Sens DDM

6. CSE R F

7. CSE SDM

8. CSE DDM

9. FFM DDM

10. CSE (C t SB) P

11. CSE (SBO) P_0

12. CLR (C t SB) P_0

13. CLR (SBO) P_O

14. Batt. chg. volt.

15. Batt. chg. current

16. CSE T X DBLR

17. CSE T X Preamp

18. CSE Amp

19. CSE 18V

20. CSE var. volts

21. CSE det. RF

22. CLR TX DBLR

23. CLR Preamp

24. CLR TX Amp

25. CLR TX 18V

26. CLR TX var. volts

27. CLR TX det. RF

28. CSE TX DBLR

29. PS voltage +5

30. PS voltage -18

31. PS voltage -50

32. Main On

33. STBY On

34. Transmittor Off

35. Abn. Monitor

36. Local Control

37. Monitor Locally Bypassed

38. Cycle (From Tower)

39. Interlock Control (From Tower)

-3.2.2.1.3.1.2 Glideslope Parameters. - The following is a list of typical

arameters to be monitored (from both monitor 1 and monitor 2) remotely:

1. CLR RF

2. CLR SDM

3. CLR DDM

4. Sens DDM

5. CSE R F

6. CSE SDM

7. CSE DDM

8. NF DDM

9. CSE $(C + SB)P_0$

10. CSE $(SBO)P_O$

11. CLR $(C_t SB)P_0$

12. Upper Ant. P_O

13. Mid Ant. P_O

14. Lwr Ant. P_O

13. CLR (SBO) P_O

14. Batt. chg. volt.

15. Batt. chg. current

16. CSE T X DBLR

17. CSE T X Preamp

18. CSE Amp

19. CSE 18V

20. CSE var. volts

21. CSE det. RF

22. CLR TX DBLR

23. CLR Preamp

24. CLR TX Amp

25. CLR TX 18V

26. CLR TX var. volts

27. CLR TX det. RF

28. CSE TX DBLR

29. PS voltage +5

30. PS voltage -18

31. PS voltage -50

32. Main On

33. STBY On

34. Transmittor Off

35. Abn. Monitor

36. Local Control

37. Monitor Locally Bypassed

38. Cycle (From Tower)

39. Interlock Control (From Tower)

-3.2.2.1.3.1.2 Glideslope Parameters. - The following is a list of typical parameters to be monitored (from both monitor 1 and monitor 2) remotely:

1. CLR RF

2. CLR SDM

3. CLR DDM

4. Sens DDM

5. CSE R F

6. CSE SDM

7. CSE DDM

8. NF DDM

9. CSE (C + SB)P_0

10. CSE (SBO)P_O

11. CLR (C + SB)P_0

12. Upper Ant. P_O

13. Mid Ant. P_O

14. Lwr Ant. P_O

9. Main On

10. Main Off

11. Abnormal

12. Local Control

13. Monitor Bypassed

14. Cycle (From Tower)

5-3.2.2.1.4 Alarm Detection 'Software. - The parameter data collected from the ILS and environmental sensors, shall be compared with tolerance limits. Upon detection of an out-of-tolerance condition, the input data buffer shall be transferred to the alarm buffer and an alarm message prepared for trans-mission to the CPS. The capability shall be provided to modify the parameter tolerance limits from the local terminal or the CPS. Whenever a parameter limit is changed, a limit change message shall be sent to the CPS. Safe-guards shall be incorporated to preclude unauthorized or inadvertent alteration of these parameters and limits from the local terminal.

5-3.2.2.1.5 Fault Diagnostic Software. - Automatic means shall be provided to diagnose the cause of a fault to a particular ILS parameter. The resulting data shall be stored in memory and transmitted to the CPS or the local terminal on request.

5-3.2.2.1.6 Microcomputer Self-Test Software. - Software shall be provided to automatically perform internal self-testing of the facility microprocessor and memory on a periodic basis. If a fault is detected, an alarm message shall be sent, to the CPS.

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9. Main On

10. Main Off

11. Abnormal

12. Local Control

13. Monitor Bypassed

14. Cycle (From Tower)

5-3.2.2.1.4 Alarm Detection 'Software. - The parameter data collected from the ILS and environmental sensors, shall be compared with tolerance limits. Upon detection of an out-of-tolerance condition, the input data buffer shall be transferred to the alarm buffer and an alarm message prepared for transmission to the CPS. The capability shall be provided to modify the parameter tolerance limits from the local terminal or the CPS. Whenever a parameter limit is changed, a limit change message shall be sent to the CPS. Safeguards shall be incorporated to preclude unauthorized or inadvertent alteration of these parameters and limits from the local terminal.

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replacement of components. Off-the-shelf components and assemblies shall be used to the greatest extent possible. Construction and fabrication of the FPU shall be in accordance with best commercial practices.

Because of space limitations at field facilities, the physical size of the FPU shall be kept as small as possible, consistent with the accessibility and maintainability requirements.

5-3.3.2 **Ventilation and Cooling.** - All blowers, vents, and cooling of the equipment shall be provided. Each cabinet requiring forced ventilation shall contain its own blower system, and shall not overheat or develop hot spots in the surrounding air exceeding 131 degrees Fahrenheit (55 degrees Celsius) with access doors or cover open for servicing for up to 8 hours. Input air filters for all equipment cabinets shall be provided in accordance with best commercial practice.

5-3.3.3 **Power Indicators and Fuses.** - Fuses shall be readily replaceable and located in a convenient serviceable location. Indicator lamps shall be provided on each cabinet to display power on/off condition.

5-3.3.4 **Subsystem Grounding.** - The grounding design of the FPU's must be compatible with other equipment with which their system will interface. There shall be no degradation of signals between equipments due to cross-coupling through the ground system. The contractor shall be responsible for interfacing his system grounding with existing systems.

5-3.3.4. 1 Lightning Protection. - The FPU equipment shall be protected against damage or operational upset due to lightning induced surges on the incoming AC power lines or data communications lines. For design and test purposes, the equipment contractor may assume that the facility is provided with AC surge arrestors installed across each power line to ground at the facility main service' disconnect box.

5-3.3.5 Conducted and Radiated Interference. - The equipment specified herein shall satisfy the basic limits of interference and susceptibility as specified in MIL-STD-461. Should the proposed equipment have been built to comply with a military interference control specification other than MIL-STD-461 (e.g., MIL-I-16910), the FAA will accept that specification in lieu of MIL-STD-461 provided that the requirements of the two specifica- tions are generally comparable.

5-3.3.6 Cables. - The contractor shall furnish all cables, cable connectors, terminal boards, etc., required for factory and site testing and installation of the equipment. This shall include any special purpose test cables or card extenders required for routine maintenance. All external cables or wires to the FPU cabinet(s) (except the primary AC power cable), shall enter the cabinets via appropriately-sized connectors. All cables shall be supplied with connectors installed. Any special tools and instructions required for cable fabrication shall be furnished by the contractor as special test equipment.

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5-3. 3. 9 Electrical Design. - The electrical design of the system shall minimize total electrical power consumption and be in accordance with best commercial practices. The primary AC power input connection shall be via a line cord with a three-prong plug. The AC source receptacle will be GFE

5-3. 3.10 Reliability and Maintainability. - The reliability and maintainabili requirements specified herein shall apply to the equipment within. the FPU.

5-3. 3.10. 1 FPU Reliability and Maintainability. - Each FPU shall have a minimum acceptable Mean-Time-Between-Failures (MTBF) of 4000 hours (excluding indicator lamps, fuses, etc.). The Mean-Time-To-Repair (MTTR) shall be 2 hours or less. Failure of an individual parameter sensor shall not be considered an FPU failure.

5-3. 3.10.2 Maintenance Approach. - The maintenance approach shall be to localize failures through the use of software and hardware maintenance features, and to replace the failed module, element, or pluggable unit from spares. The actual repair of the replaced item shall be accomplished off-line in a bench repair area.

The FPU shall be designed to minimize the requirement for preventive maintenance. Each FPU shall require not more than 1 hour per month for this purpose.

5-3.4 Documentation. - Documentation required under the contract shall be as specified in Part 1 of the ER and as specified in the following paragraphs. Documentation detailed under Part 1 of the ER applies to all parts of the CCD/RMMS while the following paragraphs specifically relate to the ILS FPU.

The contractor may utilize existing material or material that may contain the required information within an existing document. Submission and approval of documentation material shall be in the quantities and in accordance with the schedule specified in the contract. Updating of the required documentation shall be accomplished periodically to maintain the documentation in current status.

5-3.4. 1 Hardware Documentation. - Hardware documentation shall be provided in accordance with the requirements of Part 1 of the ER.

5-3.4.2 Software Documentation. - An ILS subsystem functional specification and design specification shall be, supplied in accordance with Part 1 of this ER. The contractor shall provide all documentation necessary for FAA to maintain and modify all deliverable programs. The organization of all documentation shall be complete and conform to accepted program documentation practices. Where flow charts occur within the documentation, all symbols used shall conform to ANSI standards. As a minimum, the software documentation shall include the items described in the following paragraphs.

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The contractor may utilize existing material or material that may contain the required information within an existing document. Submission and approval of documentation material shall be in the quantities and in accordance with the schedule specified in the contract. Updating of the required documentation shall be accomplished periodically to maintain the documentation in current status.

5-3.4.1 Hardware Documentation. - Hardware documentation shall be provided in accordance with the requirements of Part 1 of the ER.

5-3.4.2 Software Documentation. - An ILS subsystem functional specification and design specification shall be, supplied in accordance with Part 1 of this ER. The contractor shall provide all documentation necessary for FAA to maintain and modify all deliverable programs. The organization of all documentation shall be complete and conform to accepted program documentation practices. Where flow charts occur within the documentation, all symbols used shall conform to ANSI standards. As a minimum, the software documentation shall include the items described in the following paragraphs.

The manual shall provide information primarily on the programs external characteristics and operating procedures rather than their internal logic and construction. It shall list all available commands for both normal and maintenance modes of operation, and provide a description of each. The manual shall describe outputs available, provide samples, and describe how to obtain them. A list of all error messages shall be provided, with the procedure to follow for each error condition. Initial system startup and restart procedures shall be described. The manual shall also include the relationship of the manual to other documentation manuals.

5-4 QUALITY ASSURANCE PROVISIONS

5-4.1 General. - General provisions for providing and maintaining a quality control program are detailed in Part 1 of the ER.

5-5 PREPARATION FOR DELIVERY

See Part 1 of the ER.

5-6 NOTES

The manual shall provide information primarily on the programs external characteristics and operating procedures rather than their internal logic and construction. It shall list all available commands for both normal and maintenance modes of operation, and provide a description of each. The manual shall describe outputs available, provide samples, and describe how to obtain them. A list of all error messages shall be provided, with the procedure to follow for each error condition. Initial system startup and restart procedures shall be described. The manual shall also include the relationship of the manual to other documentation manuals.

5-4 QUALITY ASSURANCE PROVISIONS

5-4.1 General. - General provisions for providing and maintaining a quality control program are detailed in Part 1 of the ER.

5-5 PREPARATION FOR DELIVERY

See Part 1 of the ER.

5-6 NOTES

6-2 APPLICABLE DOCUMENTS

6-2.1 Applicable Documents. – In addition to the following, Part 1 contains a list of documents applicable to all parts of the ER:

FAA Order #6850.5

Instruction book for Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights. TI6850.9

Technical Manual for Runway Visual Range (RVR) Remote Display System. T.O. 31MI-4-7-2-(1 through 4).

6-3 REQUIREMENTS

6-3.1 Equipment to be Furnished by the Contractor

6-3.1.1 Hardware. – The following items shall be furnished:

Unit	Quantity
(1) Facility Processing Unit (FPU) for each site including the following:	1 per MALSI 1 per ALS 1 per VASI 1 per RVR
a. Microcomputer including memory	
b. Data communications unit (modem)	
c. Status /control interface	
d. Uninterruptable power supplies	

6-3.1.2 Software. – For each FPU delivered, the following software shall be considered as equipment and shall be provided:

(1) Remote Maintenance Monitor (RMM) operational program

(2) FPU maintenance program

6-3.1.3 Documentation. – Hardware and software documentation shall be provided as described in paragraph 6-3.4.

6-3.2 Performance Requirements. – These subparagraphs contain requirements applicable to all items for the FPU of the specification.

6-3.2.1 Hardware

6-3.2.1.1 Microcomputer. - Each microcomputer shall provide the capability to collect all available data for a lighting system via the lighting system status/control interface. Each microcomputer shall have a serial communications interface at RS-449/232C levels for the purpose of transmitting and receiving data from the local terminal, and a serial communications interface at RS-449/232C levels for the purpose of transmitting and receiving data from the communications unit. The microcomputer shall contain the hardware required to perform fault diagnosis upon the lighting system. The microcomputer must be capable of executing all requirements described elsewhere in this specification, plus 50 percent additional workload. The microcomputer shall use a minimum 8-bit word length. The microcomputer and all other FPU hardware shall not adversely affect any signal or operation of the lighting system equipment, even in the event of FPU hardware failure. The microcomputer shall contain the necessary hardware/software to accomodate reinitialization of the software locally and remotely.

6-3.2.1.1.1 Microcomputer Front Panel. - The microcomputer front panel shall contain the following features:

(1) Connector for the attachment of a portable terminal (RS-449/232C compatible).

(2) A reset button to reinitialize the software.

(3) Maintenance/normal switch.

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6-3.2.1 Hardware

6-3.2.1.1 Microcomputer. - Each microcomputer shall provide the capability to collect all available data for a lighting system via the lighting system status/control interface. Each microcomputer shall have a serial communications interface at RS-449/232C levels for the purpose of transmitting and receiving data from the local terminal, and a serial communications interface at RS-449/232C levels for the purpose of transmitting and receiving data from the communications unit. The microcomputer shall contain the hardware required to perform fault diagnosis upon the lighting system. The microcomputer must be capable of executing all requirements described elsewhere in this specification, plus 50 percent additional workload. The microcomputer shall use a minimum 8-bit word length. The microcomputer and all other FPU hardware shall not adversely affect any signal or operation of the lighting system equipment, even in the event of FPU hardware failure. The microcomputer shall contain the necessary hardware/software to accomodate reinitialization of the software locally and remotely.

6-3.2.1.1.1 Microcomputer Front Panel. - The microcomputer front panel shall contain the following features:

(1) Connector for the attachment of a portable terminal (RS-449/232C compatible).

(2) A reset button to reinitialize the software.

(3) Maintenance/normal switch.

3

6-3.2.1.4 Uninterruptable **Power Supplies.** - **Sufficient** uninterruptable **power backup is required to maintain the** FPU **(including the modem) for a period of at least 8 hours. Batteries used shall be non-acid type. Switchover transients shall not affect the operation of the** FPU **equipment.**

6-3.2.1.5 Sharing of FPU. - **Where signals of two or more lighting systems are available at one location, the** FPU **may be shared.**

6-3.2.2 Software. - **The following software is considered as equipment for the purposes of this specification and shall be provided.**

6-3.2.2.1 RMM **Software.** - **The** RMM **software shall provide the capability to control the lighting system equipment and to perform data collection of all available data. It shall perform tests upon this data to determine if** faults, alarms, **or status changes of any monitored parameter have occurred, These faults, alarms, or status changes shall be transmitted (in accordance with the** ICD **for** RMMS) **to the** CPS.

In the event of a communications failure between the facility and central site, the software shall continue to collect and test data. During a communi- cations failure, the pre-alarm and **alarm data shall be stored and maintained in memory until communications is** re-established. **The** pre-alarm **and alarm data shall then be** transmitted **to the central site.**

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as pre-alarm, alarm, or periodic (certification type) data; subcategorized to identify its source (MALSR, ALS, VASI, or RVR). The software shall provide the capability of performing fault diagnosis upon the lighting system.

6-3.2.2.1.1 Initialization Software. - Software shall be provided to initializ the FPU under any of the following conditions:

(1) Initial system startup (power on)

(2) Power fail/restart

(3) Front-panel hardware reset

(4) Reset command from the CPS

Functions to be performed during initialization shall include the following:

(1) Disable interrupt

(2) Initialize parameter limits by loading default values from ROM to RAM.

(3) Initialize I/O ports

(4) Initialize flags, pointers, counters, etc.

(5) Request time-of-day from local terminal/CPS

(6) Enable interrupts

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as pre-alarm, alarm, or periodic (certification type) data; subcategorized to identify its source (MALSR, ALS, VASI, o r RVR). The software shall provide the capability of performing fault diagnosis upon the lighting system.

6-3. 2. 2. 1. 1 Initialization Software. - Software shall be provided to initializ the FPU under any of the following conditions:

    (1) Initial system startup (power on)

    (2) Power fail/restart

    (3) Front-panel hardware reset

    (4) Reset command from the CPS

Functions to be performed during initialization shall include the following:

    (1) Disable interrupt

    (2) Initialize parameter limits by loading default values from ROM to RAM.

    (3) Initialize I/O ports

    (4) Initialize flags, pointers, counters, etc.

    (5) Request time-of-day from local terminal/CPS

    (6) Enable interrupts

MALSR Parameters

(1) Steady Burning Lights - See Table 1 and Table 2

    a. On/Off Status

    b. Intensity level

    c. Operational status

    d. Input voltage

(2) Flashing Lights - See Table 1

    a. On/Off status

    b. Operational status

    c. Input voltage

    d. Flasher rate

(3) Ground- to-Ground and Air- to-Ground Control Functions

    Monitor and control hardware shall be provided to verify that the proper ground-to-ground and air-to-ground signals will turn on the MALSR equipment.

ALS Parameters

(1) Steady Burning Lights - See Table 3 and Table 4

    a. On/Off status

    b. Intensity level

    c. Regulator output current

    d. Brightness step changing time

    e. Operational status

MALSR **Parameters**

(1) Steady Burning Lights - See Table 1 and Table 2

    a. On/Off Status

    b. Intensity level

    c. Operational status

    d. Input voltage

(2) Flashing Lights - See Table 1

    a. On/Off status

    b. Operational status

    c. Input voltage

    d. Flasher rate

(3) Ground- to-Ground and Air- to-Ground Control Functions

    Monitor and control hardware shall be provided to verify that the proper ground-to-ground and air-to-ground signals will turn on the MALSR equipment.

ALS **Parameters**

(1) Steady Burning Lights - See Table 3 and Table 4

    a. **On/Off status**

    b. **Intensity level**

    c. **Regulator output current**

    d. **Brightness step changing time**

    e. **Operational status**

(3) Ground-to-Ground and Air-to-Ground Control Functions

Monitor and control hardware shall be provided to verify that the proper ground-to-ground and air-to-ground signals will turn on the VASI.

(4) Alignment

a. Vertical angular alignment - tolerance is +6 minutes from 1/2 degree below established glide path.

b. Horizontal alignment - tolerance is $\pm 1/2$ degree from being parallel to the runway.

c. Tilt switch alarm - tolerance is $\pm 1/2$ degree.

RVR Parameters

(1) Transmissivity - See Table 7

a. Transmissometer output

b. Background test

(2) Day/Night Switch Setting - See Table 7

(3) Runway Edge Lights - See Table 7 and Table 8

(4) RVR Value - See Table 7

TABLE 1. MALSR CERTIFICATION TYPE PARAMETERS

STEADYBURN LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Intensity level and output voltage	Monitor/control	See Table 2
Input voltage	Monitor	+5% of either 240V or 120VAC
Lights oper. status	Monitor	More than two lamps out per light bar; or one lamp bar out; or 20% of all lamps out

FLASHING LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Input voltage	Monitor	+5% of either 240VAC or 120VAC
Flasher rate	Monitor	120 +2 flashes per minute
Lights oper. status	Monitor	More than one light unit out

TABLE 1. MALSR CERTIFICATION TYPE PARAMETERS

STEADYBURN LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Intensity level and output voltage	Monitor/control	See Table 2
Input voltage	Monitor	±5% of either 240V or 120VAC
Lights oper. status	Monitor	More than two lamps out per light bar; or one lamp bar out; or 20% of all lamps out

FLASHING LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Input voltage	Monitor	±5% of either 240VAC or 120VAC
Flasher rate	Monitor	120 ±2 flashes per minute
Lights oper. status	Monitor	More than one light unit out

TABLE 3. ALS CERTIFICATION TYPE PARAMETERS

STEADY LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Intensity level and reg. output current	Monitor/control	See Table 4
Brightness step changing time*	Monitor	
Light oper. status	Monitor	ALSF-1 and ALSF-2: More than five lamps out per loop; SSALF/SSALR: More than four lamps out per loop

FLASHING LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Flasher rate	Monitor	120 ±2 flashes per minute
Lights oper. status	Monitor	ALSF-1, more than three units out; ALSF-2, more than two units out for the inner 1500 ft. and more than three units out for the outer 1500 ft; SSALF/SSALR, more than one unit out

*Monitor time from step to consecutive step; from level 1 to level 5; and from level 5 to level 2

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TABLE 3. ALS CERTIFICATION TYPE PARAMETERS

STEADY LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Intensity level and reg. output current	Monitor/control	See Table 4
Brightness step changing time*	Monitor	
Light oper. status	Monitor	ALSF-1 and ALSF-2: More than five lamps out per loop; SSALF/SSALR: More than four lamps out per loop

FLASHING LIGHTS

Parameter	FPU Requirement	Limits
On/Off	Monitor/control	
Flasher rate	Monitor	120 $\pm$2 flashes per minute
Lights oper. status	Monitor	ALSF-1, more than three units out; ALSF-2, more than two units out for the inner 1500 ft. and more than three units out for the outer 1500 ft; SSALF/SSALR, more than one unit out

*Monitor time from step to consecutive step; from level 1 to level 5; and from level 5 to level 2

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TABLE 5. VASI CERTIFICATION TYPE PARAMETERS

Parameters	FPU Requirement	Limits
On/Off	Monitor/control*	
Intensity level and reg. output current	Monitor/control*	See Table 6
Regulator/transformer input voltage	Monitor	$\pm 10\%$
Photoelectric control setting	Monitor	High intensity setting - within 15 minutes of sunrise; low intensity setting - within 15 minutes before sunset
VASI lamps oper. status	Monitor	Less than two lamps per box lit

*Some VASI's do not allow the control settings to be changed remotely. In these cases, the FPU is required only to monitor the status.

TABLE 5. VASI CERTIFICATION TYPE PARAMETERS

Parameters	FPU Requirement	Limits
On/Off	Monitor/control*	
Intensity level and reg. output current	Monitor/control*	See Table 6
Regulator/transformer input voltage	Monitor	$\pm 10\%$
Photoelectric control setting	Monitor	High intensity setting - within 15 minutes of sunrise; low intensity setting - within 15 minutes before sunset
VASI lamps oper. status	Monitor	Less than two lamps per box lit

*Some VASI's do not allow the control settings to be changed remotely. In these cases, the FPU is required only to monitor the status.

TABLE 7. RVR CERTIFICATION TYPE PARAMETERS

Parameter	FPU Requirement	Limits
Transmissometer output	Monitor and compute transmissivity	Alarm if less than 40 pulses per minute are detected
Background test	Initiate test, monitor background pulses	Alarm if more than 40 pulses per minute are detected
Day/night switch setting	Verify switch setting is in correct position	
Runway edge light intensity level	Monitor and verify RVR signal data converter receives correct intensity setting	See Table 8
RVR Value	Monitor RVR signal data converter and also compute own RVR value; compare both RVR values	Alarm if the two RVR values differ by more than 500 feet and the lower of the two RVR values is at least 3000 feet, or the two RVR values differ by more than 200 feet if the higher of the two RVR values is 3000 feet or less
RVR change	Compare RVR values at 15-minute intervals and determine if RVR value is increasing, decreasing, or unchanged	

TABLE 8. RUNWAY EDGE LIGHT INTENSITY SETTINGS

Intensity Level	Regulator Output Current (AMPS)	Limits (AM:
5	6.6	6.4 - 6.7
4	5.2	4.9 - 5.5
3	4.1	3.8 - 4.4
2	3.4	3.2 - 3.7
1	2.8	2.6 - 3.1

TABLE 8. RUNWAY EDGE LIGHT INTENSITY SETTINGS

Intensity Level	Regulator Output Current (AMPS)	Limits (AM:
5	6.6	6.4 - 6.7
4	5.2	4.9 - 5.5
3	4.1	3.8 - 4.4
2	3.4	3.2 - 3.7
1	2.8	2.6 - 3.1

6-3.2.2.1.8 Maintenance/Normal Software. - Software shall be provided to notify the CPS when the maintenance/normal switch on the front panel is moved to either the maintenance or normal position. When the switch is in the maintenance position, the RMM software shall operate in conjunction with the maintenance software. In this mode, all messages sent to the CPS should be flagged as being in the maintenance mode.

6-3.2.2.2 Maintenance Program. - As a minimum, the maintenance progra shall perform the following functions upon command from the local terminal

    (1) Discontinue communications to the CPS

    (2) Allow the examination of all registers and memory

    (3) Execute a ROM test to validate all ROM's

    (4) Execute a RAM test to read/write to ail RAM's

    (5) Exercise the interfaces between the microcomputer and the status/control interface, and between the microcomputer and the communica tions unit.

6-3.2.2.1.8 Maintenance/Normal Software. - Software shall be provided to notify the CPS when the maintenance/normal switch on the front panel is moved to either the maintenance or normal position. When the switch is in the maintenance position, the RMM software shall operate in conjunction with the maintenance software. In this mode, all messages sent to the CPS should be flagged as being in the maintenance mode.

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    (3) Execute a ROM test to validate all ROM's

    (4) Execute a RAM test to read/write to ail RAM's

    (5) Exercise the interfaces between the microcomputer and the status/control interface, and between the microcomputer and the communica tions unit.

6-3.3.4 Subsystem Grounding. - The grounding design of, the FPU's must be compatible with other equipment with which their system will interface. There shall be no degradation of signals between equipments due to cross-coupling through the ground system. The contractor shall be responsible for interfacing his system grounding with existing sys terns.

(see page 22a)

6-3.3.5 Conducted and Radiated Interference. - The equipment specified herein shall satisfy the basic limits of interference and susceptibility as specified in MIL-STD-461. Should the proposed equipment have been built to comply with a military interference control specification other than MIL-STD-461 (e.g., MIL-I-16910), the FAA will accept that specification in lieu of MIL-STD-461 provided that the requirements of the two specifica·tions are generally comparable.

6-3.3.6 Cables. - The contractor shall furnish all cables, cable connector: terminal boards, etc., required for factory and site testing and installation of the equipment. This shall include any special purpose test cables or card extenders required for routine maintenance. All external cables or wires to the FPU cabinet(s) (except the primary AC power cable), shall enter the cabinets by appropriately-sized connectors. All cables shall be supplied with connectors installed.. Any special tools and instructions required for cable fabrication shall be furnished by the contractor as special test equipment.

6-3.3.4.1 Lightning Protection. - The FPU equipment shall be protected against damage or operational upset due to lightning induced surges on the incoming AC power lines or data communications lines. For design and test purposes, the equipment contractor may assume that the facility is provided with AC surge arrestors installed across each power line to ground at the facility main service disconnect box.

6-3.3.4.1 Lightning Protection. - The FPU equipment shall be protected against damage or operational upset due to lightning induced surges on the incoming AC power lines or data communications lines. For design and test purposes, the equipment contractor may assume that the facility is provided with AC surge arrestors installed across each power line to ground at the facility main service disconnect box.

6-3.3.7 Service Conditions. - The FPU equipment herein shall perform in accordance with the requirements of this ER under the service conditions, including AC line parameters, listed below:

Operating (Power On)

1. 0-10,000 feet (0-2048 meters) altitude above sea level.

2. 14 to 122 degrees Fahrenheit (-10 to 50 degrees Celsius) temperature (cabinet intake air temperature).

3. 5 percent to 90 percent relative humidity.

4. Direct air conditioning shall not be required.

5. AC line parameters:

Design Center	Range
120 volts	108-132 volts
208 volts	187-229 volts
60Hz	57-63Hz

6-3.3.8 Electrical Service Conditions

6-3.3.8.1 Transient State. - All equipment shall perform its specified function in accordance with the requirements of 1- 3.3.4 and 1-3.3.5 of FAA-G-2100 pertaining to AC power source transients. No false operational or output signals shall be generated by transients within the defined limits or by inrush currents caused by the FPU.

6-3.3.8.2 Startup Surges. - The peak inrush current during startup shall not exceed five times the normal peak operating current.

6-3. 3. 9 Electrical Design. - The electrical design of the system shall minimize total electrical power consumption and be in accordance with best commercial practices. The primary AC power input connection shall be via a line cord with a three-prong plug. The AC source receptacle will be GFE.

6-3. 3. 10 Reliability and Maintainability. - The reliability and maintainability requirements specified herein shall apply to the equipment within the FPU.

6-3. 3. 10.1 FPU Reliability and Maintainability. - Each FPU shall have a minimum acceptable Mean-Time-Between-Failures (MTBF) of 4000 hours (excluding indicator lamps, fuses, etc.). The Mean-Time-To-Repair (MTTR) shall be 2 hours or less. Failure of an individual parameter sensor shall not be considered an FPU failure.

6-3.3.10.2 Maintenance Approach. - The maintenance approach. shall be to localize failures through the use of software and hardware maintenance features, and to replace the failed module, element, or pluggable unit from spares. The actual repair of the replaced item shall be accomplished off-line in a bench repair area.

The FPU shall be designed to minimize the requirement for preventive maintenance. Each FPU shall require not more than 1 hour per month for this purpose.

6-3. 3. 9 Electrical Design. - The electrical design of the system shall minimize total electrical power consumption and be in accordance with best commercial practices. The primary AC power input connection shall be via a line cord with a three-prong plug. The AC source receptacle will be GFE.

6-3. 3. 10 Reliability and Maintainability. - The reliability and maintainability requirements specified herein shall apply to the equipment within the FPU.

6-3. 3. 10.1 FPU Reliability and Maintainability. - Each FPU shall have a minimum acceptable Mean-Time-Between-Failures (MTBF) of 4000 hours (excluding indicator lamps, fuses, etc.). The Mean-Time-To-Repair (MTTR) shall be 2 hours or less. Failure of an individual parameter sensor shall not be considered an FPU failure.

6-3.3.10.2 Maintenance Approach. - The maintenance approach. shall be to localize failures through the use of software and hardware maintenance features, and to replace the failed module, element, or pluggable unit from spares. The actual repair of the replaced item shall be accomplished off-line in a bench repair area.

The FPU shall be designed to minimize the requirement for preventive maintenance. Each FPU shall require not more than 1 hour per month for this purpose.

be reviewed and approved by the government and quantities supplied in accordance with the contract schedule.

6-3.4.2.1 Program Manuals. - An RMM program manual and a maintenanc program manual shall be furnished with sufficient detail to allow FAA personnel to make program modifications. Each program manual shall include an overview of all routines and their interrelationships to the hardware, and shall describe how the functional requirements of the subsys tern were met. Each program manual shall also contain logical flow charts and source listings for each routine described. The source listings shall represent the final delivered software and contain sufficiently detailed comments to adequately describe the purpose of. each subfunction, Each program manual shall include, but not be limited to, the following:

    1. Procedures for updating the manual.

    2. Relationship to other software manuals.

    3. Detailed explanation of hardware related programming factors such as input/output formats, codes, bit patterns for control characters, communication sequences, interrupt processing, and I/O port addresses.

    4. Detailed description of memory requirements, including a load map with global symbols.

6-3.4.2. 2 Operator's Manual. - The operator's manual shall provide detailed operating procedures for both the normal and maintenance modes of operation. The manual shall provide information primarily on the

programs external characteristics and operating procedures rather than their internal logic and construction. It shall list all available commands for both normal and maintenance modes of operation, and provide a description of each. The manual shall describe outputs available, provide samples, and describe how to obtain them. A list of all error messages shall be provided, with the procedure to follow for each error condition. Initial system startup and restart procedures shall be described. The manual shall also include the relationship of the manual to other documentation manuals.

6-4 QUALITY ASSURANCE PROVISIONS

6-4. 1 General. - General provisions for providing and maintaining a quality control program are detailed in Part 1 of the ER.

6-5 PREPARATION FOR DELIVERY

See Part 1 of the ER

6-6 NOTES

programs external characteristics and operating procedures rather than their internal logic and construction. It shall list all available commands for both normal and maintenance modes of operation, and provide a description of each. The manual shall describe outputs available, provide samples, and describe how to obtain them. A list of all error messages shall be provided, with the procedure to follow for each error condition. Initial system startup and restart procedures shall be described. The manual shall also include the relationship of the manual to other documentation manuals.

6-4 QUALITY ASSURANCE PROVISIONS

6-4. 1 General. - General provisions for providing and maintaining a quality control program are detailed in Part 1 of the ER.

6-5 PREPARATION FOR DELIVERY

See Part 1 of the ER

6-6 NOTES

CONSOLIDATED CAB DISPLAY/REMOTE
MAINTENANCE MONITOR SYSTEM

FOREWARD

This is Part 7 of a group of specification documents under the basic
heading, "Consolidated Cab Display/Remote Maintenance Monitor System
(CCD/RMMS)," each of which carries the basic number Engineering Requirement
(ER) with a slant line and a number corresponding to the part number.

Listing of Parts:

7-1 SCOPE

7-1.1 Scope of Part **7.-** This **Part 7** contains requirements which are
applicable, alone and in conjunction, with other parts of this Engineering
Requirement, to the design, fabrication, testing, installation, and field
validation of a tower interface subsystem of a **CCD/RMM** System to be
installed and operated in FAA terminal facilities. The tower interface
subsystem shall consist of dual facility processing units **(FPU's)** to
provide redundancy for the monitoring of environmental (i.e., weather) and
navaid status parameters presently being terminated/interfaced in the
tower. Each **FPU** shall be comprised of a microcomputer, data communications
unit (modem), status/control interface, and an **uninterruptable** power
supply. Both **FPU's** shall continuously monitor the environmental and **navaid**
status parameters. One **FPU** shall be designated "active" and other
"standby". The active **FPU** shall detect alarm conditions by comparing
measured parameters for abnormal state. Upon alarm detection, the active
FPU shall notify the central processing subsystem **(CPS)** in accordance with
the **ICD** Level I and **ICD** Level II specifications. Upon request from the
CPS, the active **FPU** shall transmit all data available for use at the **CPS.**

7-1.2 Applicable Definitions

Interface Control Document Level I - An FAA document that provides
the communications link control interface and **protocal** requirements
for the exchange of information between a remote monitoring
subsystem (i.e., **FPU)** and a central processing subsystem **(CPS).**

Listing of Parts:

FAA-ER-500-007/1   Part 1 - General

FAA-ER-500-007/2   Part 2 - Display Subsystem

FAA-ER-500-007/3   Part 3- Central Processing Subsystem

FAA-ER-500-007/4   Part 4 - Remote Transmitter/Receiver Subsystem

FAA-ER-500-007/5   Part 5 - Instrument Landing System Subsystem

FAA-ER-500-007/6   Part 6 - **Lighting/RVR** Subsystem

FAA-ER-500-007/7   Part 7 - Tower Interface Subsystem

7-1 SCOPE

7-1.1 Scope of Part **7.**- This **Part** 7 contains requirements which are applicable, alone and in conjunction, with other parts of this Engineering Requirement, to the design, fabrication, testing, installation, and field validation of a tower interface subsystem of a **CCD/RMM** System to be installed and operated in FAA terminal facilities. The tower interface subsystem shall consist of dual facility processing units **(FPU's)** to provide redundancy for the monitoring of environmental (i.e., weather) and **navaid** status parameters presently being terminated/interfaced in the tower. Each **FPU** shall be comprised of a microcomputer, data communications unit (modem), status/control interface, and an **uninterruptable** power **supply.** Both **FPU's** shall continuously monitor the environmental and **navaid** status parameters. One **FPU** shall be designated "active" and other "standby". The active **FPU** shall detect alarm conditions by comparing measured parameters for abnormal state. Upon alarm detection, the active **FPU** shall notify the central processing subsystem **(CPS)** in accordance with the **ICD** Level I and **ICD** Level II specifications. Upon request from the **CPS,** the active **FPU** shall transmit all data available for use at the **CPS.**

7-1.2 Applicable Definitions

Interface Control Document Level I - An FAA document that provides the communications link control interface and **protocal** requirements for the exchange of information between a remote monitoring subsystem (i.e., **FPU)** and a central processing subsystem **(CPS).**

RMM   Remote Maintenance Monitor

RMMS   Remote Maintenance Monitor System

SMD   Supervisory/Maintenance Display

kUPS   **Uninterruptable** Power Supply

7-2 Applicable Documents

7-2.1 Applicable **Documents.-** The following documents are specifically referenced in this part of the **ER** and are applicable to the extent specified herein.

7-2.1.1 FAA Documents

Specification

FAA-G-2100/1   Electronic Equipment, General Requirements

Miscellaneous

NAS-MD-790   Level I Interface Control Document for RMMS

7-2.1.2 Military Document

Standard

MIL-STD-461   Electromagnetic Interference Characteristics
                  Requirements for Equipment

7-2.1.3 Miscellaneous Documents

Electronics Industries Association

EIA-RS-232C   Interface Between Data Terminal Equipment and Data
                  Communications Equipment Employing Serial Binary
                  Data Interchange

EIA-RS-449	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
EIA-Bulletin #12	Application Notes on Interconnection Between Interface Circuits Using RS-449 and RS-232C

7-2.2 Precedence of **Documents.-** When requirements of the contract, this ER, or subsidiary applicable documents are in conflict, the following shall apply:

7-2.2.1 The **Contract.-** The contract **shall have** precedence over all other documents.

7-2.2.2 Engineering **Requirement.-** The ER shall have precedence over all subsidiary applicable documents cited herein.

7-2.3 Source of Documents

7-2.3.1 Source of FAA **Documents.-** Copies of the applicable FAA documents may be obtained from the Federal Aviation Administration, Washington, DC, 20591, Attention: Contracting Officer. Request should fully identify material desired, i.e., document number, dates, amendment numbers; also, request should identify the invitation for bid, request for proposals, or the contract involved. Or other use to be made of the requested material.

7-2.3.2 Source of Military **Document.-** Single copies of the military document may be obtained from the Naval Supply Depot, 5801 **Tabor** Avenue, Philadelphia, PA, 19120. Request should cite the request for proposal or contract for which the document is needed.

7-2.3.3 Source of Other **Documents.-** Single copies of **EIA** publications may be obtained from the Electronic Industries Association, 2001 Eye Street, **N.W.,** Washington, DC, 20006.

7-3 Requirements

7-3.1 Equipment to be Furnished by the Contractor

7-3.1.1 Hardware.- The following items shall be furnished.

EIA-RS-449   Interface Between Data Terminal Equipment and
                      Data Circuit-Terminating Equipment Employing
                      Serial Binary Data Interchange

EIA-Bulletin #12   Application Notes on Interconnection Between
                      Interface Circuits Using RS-449 and RS-232C

7-2.2 Precedence of Documents.- When requirements of the contract, this
ER, or subsidiary applicable documents are in conflict, the following shall
apply:

7-2.2.1 The Contract.- The contract shall have precedence over all other
documents.

7-2.2.2 Engineering Requirement.- The ER shall have precedence over all
subsidiary applicable documents cited herein.

7-2.3 Source of Documents

7-2.3.1 Source of FAA Documents.- Copies of the applicable FAA documents
may be obtained from the Federal Aviation Administration, Washington, DC,
20591, Attention: Contracting Officer. Request should fully identify
material desired, i.e., document number, dates, amendment numbers; also,
request should identify the invitation for bid, request for proposals, or
the contract involved. Or other use to be made of the requested material.

7-2.3.2 Source of Military Document.- Single copies of the military
document may be obtained from the Naval Supply Depot, 5801 Tabor Avenue,
Philadelphia, PA, 19120. Request should cite the request for proposal or
contract for which the document is needed.

7-2.3.3 Source of Other Documents.- Single copies of EIA publications may
be obtained from the Electronic Industries Association, 2001 Eye Street,
N.W., Washington, DC, 20006.

7-3 Requirements

7-3.1 Equipment to be Furnished by the Contractor

7-3.1.1 Hardware.- The following items shall be furnished.

7-3.2.1.1.1 Microcomputer Front **Panel.-** The microcomputer front panel shall contain the following features:

(a) Connector for the **attachment** of a portable terminal **(RS-449/232C** compatible).

(b) A reset button to reinitialize the software.

(c) Maintenance/normal switch.

7-3.2.1.1.2 Memory.- Memory shall consist of a combination of eraseable programmable read only memory (EPROM) and random access memory (RAM). Both RAM and EPROM shall be capable of being expanded without the addition of a second chassis, by the greater of **25** percent of **4K** words over that required to meet the requirements of this specification.

7-3.2.1.1.2 Real-Time **Clock.-** A real-time clock with a minimum resolution of 1 millisecond, that is under programmable control of the microcomputer, shall be supplied.

7-3.2.1.2 Data Communications Unit (Modem).- The data communications unit shall be a commercially available modem. It shall have an **RS-449/232C** compatible interface to the microcomputer and shall be capable of transmitting/receiving data at rates up to and including **1200** bps. The modems shall operate from the **uninterruptable** power supplies (UPS) during power outages. The modems shall be of the same product line as the modems at the **CPS.**

7-3.2.1.3 Status/Control **Interface.-** The status/control interface shall interface to a signal **demarc box(es).** The signal **demarc box(es)** will be **GFE** and will be a central point for all signals (parameters) to be monitored. The sensors and other hardware necessary to monitor the environmental and **navaid** status parameters shall be provided by the contractor. The parameters to be monitored and their characteristics shall be as specified in the contract. Sufficient isolation shall be provided by the contractor to insure the **FPU** hardware shall not adversely affect any signal or operation of the existing facility equipment even in the event of **FPU** hardware 'failure.

7-3.2.1.4 **Uninterruptable** Power **Supplies.-** Sufficient **uninterruptable** power backup is required to maintain the FPU (including the modem) for a period of at least 8 hours. Batteries used shall be non-acid type. Switchover transients shall not affect the operation of the FPU equipment.

7-3.2.1.5 Dual **FPU's.-** Two **FPU's** shall be supplied and shall perform independently of each other. The only common point between the **FPU's** shall be the signal **demarc box(es).** The malfunction of an FPU shall not hinder the performance of the other FPU or **CPS.** When the maintenance/normal switch on the front panel of an FPU is in the normal **poisition, the** CPS shall select the mode of operation (active or standby) of the FPU. When the maintenance/normal switch of an FPU is in the maintenance position, the FPU shall automatically assume standby mode of operation.

7-3.2.2 Software.- The following software is considered as equipment for the purposes of this specification and shall be provided.

7-3.2.2.1 RMM **Software.-** The RMM software shall provide the capability to perform data acquisition of all available data. It shall perform tests upon this data to determine if faults, alarms, or status changes of any monitored parameter have **occured.** These faults, alarms, or status changes shall be transmitted (in accordance with ICD Level I for RMMS) to the CPS.

In the event of a communications failure between the FPU and CPS, the software shall continue to collect and test data. During a communications failure, the **pre-alarm** and alarm data shall be stored and maintained in memory until communications is **re-established.** The **pre-alarm** and- alarm data shall then be transmitted to the CPS.

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as **pre-alarm,** alarm, or periodic data; subcategorized to identify its source. The software shall provide the capability of performing fault diagnosis upon the FPU.

7-3.2.2.1.1 Initialization **Software.-** Software shall be provided to initialize the FPU under any of the following conditions:

(a) Initial system startup (power on)

(b) Power fail/restart

7-3.2.1.4 **Uninterruptable** Power **Supplies.**- Sufficient **uninterruptable** power backup is required to maintain the FPU (including the modem) for a period of at least 8 hours. Batteries used shall be non-acid type. Switchover transients shall not affect the operation of the FPU equipment.

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7-3.2.2.1 RMM Software.- The RMM software shall provide the capability to perform data acquisition of all available data. It shall perform tests upon this data to determine if faults, alarms, or status changes of any monitored parameter have **occured.** These faults, alarms, or status changes shall be transmitted (in accordance with ICD Level I for **RMMS)** to the **CPS.**

In the event of a communications failure between the FPU and CPS, the software shall continue to collect and test data. During a communications failure, the **pre-alarm** and alarm data shall be stored and maintained in memory until communications is **re-established.** The **pre-alarm** and- alarm data shall then be transmitted to the **CPS.**

The software shall provide the capability of displaying on the local terminal or transmitting to the CPS upon command, any or all data which shall have been tagged by date and time and is categorized as **pre-alarm,** alarm, or periodic data; subcategorized to identify its source. The software shall provide the capability of performing fault diagnosis upon the **FPU.**

7-3.2.2.1.1 Initialization **Software.**- Software shall be provided to initialize the FPU under any of the following conditions:

> (a) Initial system startup (power on)

> **(b)** Power fail/restart

7-3.2.2.1.5 Fault Diagnostic Software.- Automatic means shall be provided
to diagnose the cause of a fault to a particular **FPU** component (board). An
alarm message shall be generated and the resulting data stored in memory,
and transmitted to the **CPS** or the local terminal on request.

7-3.2.2.1.6 Microcomputer Self-Test **Software.-** Software shall be provided
to automatically perform internal self-testing of the facility
microprocessor and memory on a periodic basis. If a fault is detected, an
alarm message shall be sent to the **CPS.**

7-3.2.2.1.7 Trend Analysis **Software.-** All or any selected parameter data
shall be transmitted to the local terminal or **CPS** upon request at a
selected periodic rate, for the purpose of performing a quick look trend
analysis.

7-3.2.2.1.8 Maintenance/Normal **Software.-** Software shall be provided to
notify the **CPS** when the maintenance/normal switch on the front panel is
moved to either the maintenance or normal position. The maintenance/normal
switch must be in the normal position for an **FPU** to be active. When the
switch is in the maintenance position, the **RMM** software shall operate in
conjunction with the maintenance software and the **FPU** shall revert to
standby. In the maintenance mode, all messages sent to the **CPS** shall be
flagged as being in the maintenance mode.

7-3.2.2.1.9 Active/Standby **Software.-** An active **FPU** shall perform all of
the above **RMM** functions (data acquisition), alarm detection/generation, **CPS**
communications, etc.). A standby **FPU** shall not transmit any parameter
alarm messages to the **CPS** unless the standby **FPU** is in the maintenance mode
at which time all messages transmitted to the **CPS** shall be tagged as being
in the maintenance mode.

7-3.2.2.2 Maintenance Program.- As a minimum, the maintenance program
shall perform the following functions upon command from the local terminal:

(a) Enable/disable **communications** to the **CPS**

(b) Allow the examination of all registers and memory

(c) Execute an EPROM test to validate all EPROM

(d) Execute an RAM test to read/write to all RAM

(e) Exercise the interfaces between the microcomputer and the status/control interface, and between the microcomputer and the communications unit.

7-3.3 Design and Construction

7-3.3.1 General Requirements.- The FPU shall be designed to provide high operational availability and good accessibility for maintenance and repair or replacement of components. Off-the-shelf components and assemblies shall be used to the greatest extent possible and consistent with the general requirements specified in 1-3.3. Construction and fabrication of the FPU shall be in accordance with best commercial practices.

Because of space limitations, the physical size of the FPU shall be kept as small as possible, consistent with the accessibility and maintainability requirements.

7-3.3.2 Ventilation and Cooling.- All blowers, vents, and cooling of the equipment shall be provided. Each cabinet requiring forced ventilation shall contain its own blower system, and shall not overheat or develop hot spots in the surrounding ambient air exceeding 131 degrees Fahrenheit (55 degrees Celsius) with access doors open for servicing for up to 8 hours. Input air filters for all equipment cabinets shall be provided in accordance with best commercial practice.

7-3.3.3 Power Indicators and Fuses.- Fuses shall be readily replaceable and located in a convenient serviceable location. Indicator lamps shall be provided on each cabinet to display power on/off condition.

7-3.3.4 Subsystem Grounging.- The grounding design of the FPU's must be compatible with other equipment with which the subsystem will interface. There shall be no degradation of signals between equipments due to crosscoupling through the ground system. The contractor shall be responsible for interfacing his system grounding with existing system.

7-3.3.4.1 Lightning Protection.- The FPU equipment shall be protected against damage or operational upset due to lightning induced surges on the incoming AC power lines or data communications lines. For design and test purposes, the equipment contractor may assume that the facility is provided with AC surge arrestors installed across each power line to ground at the facility main service disconnect box.

7-3.3.5 Conducted and Radiated Interference.- The equipment specified herein shall satisfy the basic limits of interference and susceptibility as specified in MIL-STD-461. Should the proposed equipment have been built to comply with any interference control specification other than MIL-STD-461, the FAA will accept that specification in lieu of MIL-STD-461 provided that the requirements of the two specifications are generally comparable.

7-3.3.6 Cables.- The contractor shall furnish all cables, cable connectors, terminal boards, etc., required for factory maintenance and site testing and installation of the equipment. This shall include any special purpose test cables or card extenders required for routine maintenance. All external cables or wires to the FPU cabinet(s) (except the primary AC power cables), shall enter the cabinets by appropriately sized connectors. All cables shall be supplied with connectors installed. Any special tools and instructions required for cable fabrication shall be furnished by the contractor as special test equipment.

7-3.3.7 Service Conditions.- The FPU equipment herein shall perform in accordance with the requirements of this ER under the service conditions, including AC line parameters listed below:

Operation (Power On)

(a) 0-10,000 feet (0-2048 meters) altitude above sea level.

(b) 14 - 122 degrees Fahrenheit (-10 to 50 degrees Celsius) temperature ambient (cabinet intake air temperature).

(c) 5 percent to 90 percent relative humidity.

(d) Direct air conditioning shall not be required.

(e) AC line parameters:

Design Center	Range
120 volts	108-132 volts
208 volts	187-229 volts
60Hz	57-63Hz

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accordance with the schedule specified in the contract. Updating of the required documentation shall be accomplished periodically to **maintain** the documentation in current status.

7-3.4.1 Hardware **Documentation.-** Hardware documentation shall be provided in accordance with the requirements of Part I of the **ER.**

7-3.4.2 Software **Documentation.-** A tower interface subsystem functional specification and design specification shall be supplied in accordance with Part 1 of this **ER.** The contractor shall provide all documentation necessary for FAA to maintain and modify all deliverable programs. The organization of all documentation shall be complete and conform to accepted program documentation practices. Where flow charts occur within the documentation, all symbols used shall conform to ANSI standards. As a minimum, the software documentation shall include the items described in the following paragraphs. These documents shall be reviewed and approved by the government and quantities supplied in accordance with the contract schedule.

7-3.4.2.1 Program **Manuals.-** An **RMM** program manual and a maintenance program manual shall be furnished with sufficient detail to allow FAA personnel to make program modifications. Each program manual shall include an overview of all routines and their interrelationships to the hardware, and shall describe how the functional requirements of the subsystem were met. Each program manual shall also contain logical flow charts and source listings for each routine described. The source listings shall represent the final delivered software and contain efficiently detailed comments to adequately describe the purpose of each subfunction. Each program manual shall include, but not be limited to, the following:

(a) Procedures for updating the manual

(b) Relationship to other software manuals

(c) Detailed explanation of hardware related programming factors such as input/output formats, codes, bit patterns for control characters, communication sequences, interrupt processing, and I/O port addresses.

(d) Detailed description of memory requirements, including a load map with global symbols.

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